PRICE $2.00

HEATH COMPANY • BENTON HARBOR, MICHIGAN

HEATHKIT®
ASSEMBLY MANUAL

HEATHKIT

75-METER SSB TRANSCEIVER
MODEL HW-12A

595-829-03

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HEATH COMPANY
Benton Harbor, Michigan 49022

Assembly
and
Operation
of the

HEATHKIT®

75-METER SSB TRANSCEIVER

Model HW-12A

HEATH COMPANY
BENTON HARBOR,
MICHIGAN 49022

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INTRODUCTION

The Heathkit Model HW-12A Amateur Transceiver is a 75-meter SSB (single-sideband) transmitter and receiver designed for both mobile and fixed station use. The receiver and transmitter are locked together with a continuously running VFO (variable frequency oscillator) to insure that both sections operate at the same frequency. The low frequency VFO is temperature compensated to provide stable operation.

Provisions have been made for both PTT (push-to-talk) and VOX (voice operated transmitter) operation. Other features include ALC (automatic level control) to prevent the transmitter from overloading, and AVC (automatic volume control) to maintain constant receiver output over a wide range of input signal strength.

An accessory socket is wired into the circuit so the Heathkit plug-in Crystal Calibrator can be used with the Transceiver to provide accurate frequency checks at 100 kHz intervals. A connection on the rear of the Transceiver makes the Transceiver easily usable with linear amplifiers. Power for the Transceiver can be obtained from the Heathkit Model HP-13 (12 VDC) or Model HP-23 (120 VAC Power Supplies. Equivalent power supplies may also be used.

NOTE: This Manual uses the new IEEE (Institute of Electrical and Electronic Engineers) international standard term "hertz" as the basic unit of frequency. The terms are used as follows:

Hz (hertz)= cps (cycles per second).
kHz (kilohertz) = kc (kilocycles per second).
MHz (megahertz) = mc (megacycles per second).

Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

PARTS LIST

The key numbers in parentheses in the Parts List are keyed to the numbers on the Parts Pictorial (fold-out from Page 5). NOTE: When more than one number is on a package, disregard all but the part number, as listed below.

To order replacement parts, refer to the Replacement Parts Price List and use the Parts Order Form furnished with this kit.

PART No.	PARTS Per Kit	DESCRIPTION
RESISTORS		
1/2 Watt		
(1)1-1	1	47 Ω (yellow-violet-black)
1-3	3	100 Ω (brown-black-brown)
1-66	1	150 Ω (brown-green-brown)
1-45	5	220 Ω (red-red-brown)
1-4	2	330 Ω (orange-orange-brown)
1-9	8	1000 Ω (brown-black-red)
1-14	3	3300 Ω (orange-orange-red)
1-16	6	4700 Ω (yellow-violet-red)
1-19	1	6800 Ω (blue-gray-red)
1-20	9	10 KΩ (brown-black-orange)
1-22	4	22 KΩ (red-red-orange)
1-25	12	47 KΩ (yellow-violet-orange)
1-26	11	100 KΩ (brown-black-yellow)
1-29	8	220 KΩ (red-red-yellow)
1-35	11	1 megohm (brown-black-green)
1-37	5	2.2 megohm (red-red-green)
1-70	1	22 megohm (red-red-blue)
Other Resistors		
(2)1-28-1	1	100 KΩ 1 watt (brown-black-yellow)
3-2-2*	1	.33 Ω 2 watt (orange-orange-silver)
(3)1-21-2	1	20 Ω 2 watt (red-black-black)
1-17-2	1	6800 Ω 2 watt (blue-gray-red)
1-22-2	2	12 KΩ 2 watt (brown-red-orange)

*NOTE: This resistor is a 2 watt wire-wound resistor, but is the same size as a 1 watt composition resistor.

PART No.	PARTS Per Kit	DESCRIPTION
CAPACITORS		
Mica		
(4)20-96	3	36 pf
20-102	2	100 pf
20-112	2	310 pf
20-131	2	360 pf
20-122	3	1000 pf
20-127	2	1300 pf
Disc		
(5)21-60	7	18 pf
21-32	6	47 pf
21-49	2	68 pf
21-21	1	200 pf
21-13	7	500 pf
21-35	3	.005 µfd 1.6 KV
21-57	25	.005 µfd
21-31	30	.02 µfd
Mylar*		
NOTE: Mylar capacitors may be marked with color bands or stamped with the value.		
(6)27-73	1	.047 µfd (yellow-violet-orange)
27-85	1	.22 µfd (wide red-yellow)
27-61	3	.47 µfd (yellow-violet-yellow)
27-47	6	.1 µfd (brown-black-yellow)
Other Capacitors		
(7)25-54	2	10 µfd tubular electrolytic
(8)25-135	1	20 µfd vertical electrolytic
(9)26-104	1	Double-section variable
26-35	1	Single-section variable
COILS		
NOTE: Some of the coils or transformers may have a plastic insert which can rattle, this is normal.		
(10)40-509	1	Crystal filter
(11)40-516	1	Driver grid
40-513	1	Driver plate
(12)40-510	1	Final plate
(13)52-25	1	VFO
CHOKES-TRANSFORMERS		
(14)45-58	1	13 µh bifilar choke
(15)45-51	1	15 µh choke
(16)45-3	1	1 mh choke
(17)45-4	1	1.1 mh choke
(18)45-47	1	2 mh choke
(19)51-55	1	Audio output transformer
(20)52-63	3	2.305 MHz transformer

* Du Pont Registered Trademark

HEATHKIT

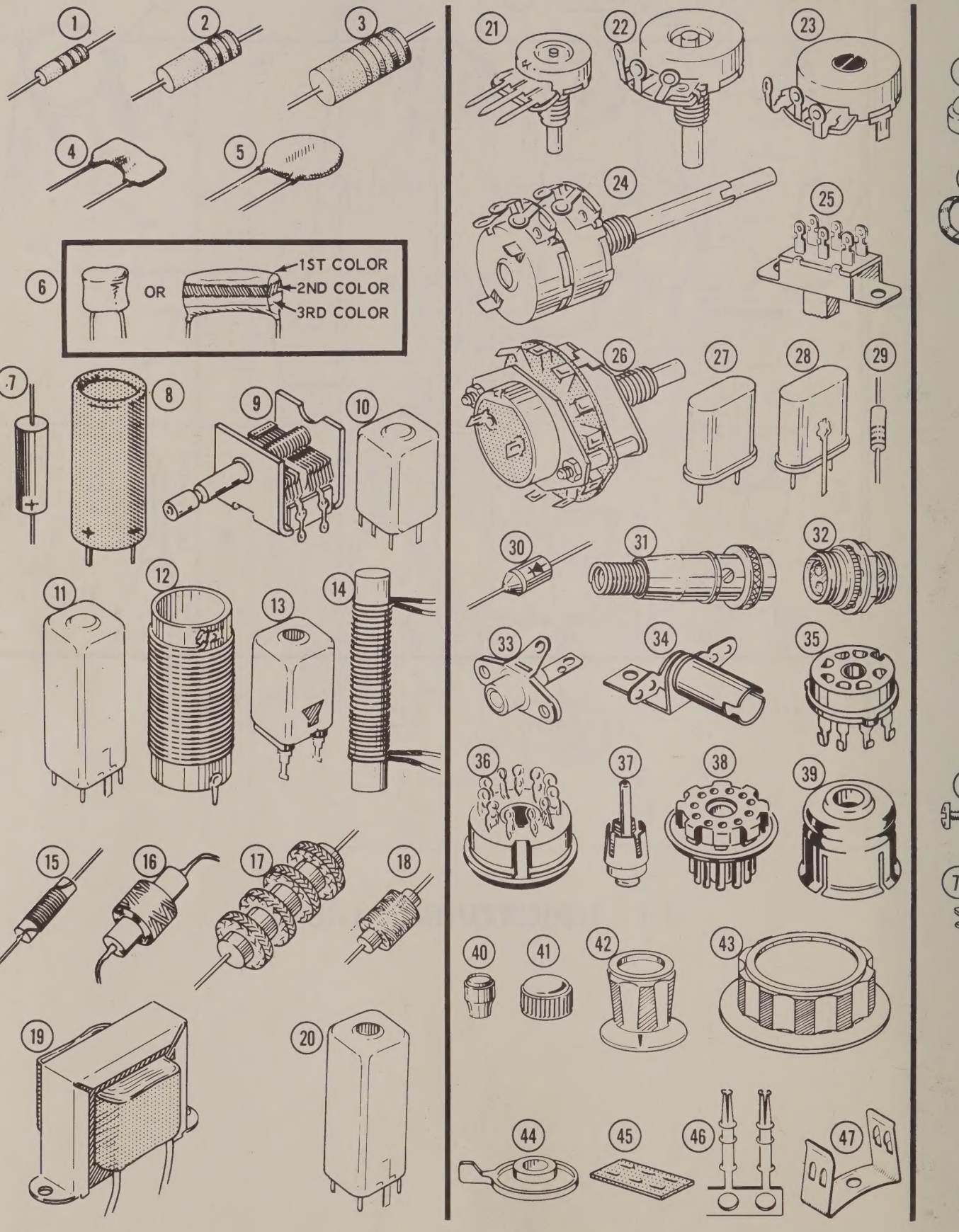
PART No.	PARTS Per Kit	DESCRIPTION
CONTROLS-SWITCHES		
(21)10-130	1	200 Ω bushing-mount control
(22)10-17	1	1 megohm bushing-mount control
(23)10-57	2	10 KΩ tab-mount control
10-58	1	100 KΩ tab-mount control
10-127	2	1 megohm tab-mount control
(24)12-73	1	1 megohm/25 KΩ dual tab-mount control
(25)60-13	2	DPDT slide switch
(26)63-427	1	5-position rotary with/snap switch
CRYSTALS		
(27)404-196	1	2303.3 kHz
404-197	1	2306.7 kHz
404-203	Package	consisting of the following:
(28) 404-191	2	2305.100 kHz
404-192	2	2303.500 kHz
DIODES-TUBES-LAMPS		
(29)56-26-1	5	Germanium diode (brown-white-brown)
(30)57-27	5	Silicon diode
411-11	5	6AU6 tube
411-91	1	6BE6 tube
411-124	3	6EA8 tube
411-161	1	6EB8 tube
411-185	2	6GE5 tube
411-24	1	12AT7 tube
411-69	1	12BY7 tube
412-1	2	#47 pilot lamp
412-11	1	NE2 neon lamp
CONNECTORS-SOCKETS-PLUGS		
(31)432-38	1	Male connector
(32)432-39	1	Female connector
(33)434-42	4	Phono socket
(34)434-44	2	Pilot lamp socket
(35)434-112	6	7-pin tube socket
434-105	1	8-pin tube socket
434-79	6	9-pin tube socket
434-140	2	12-pin tube socket
(36)434-118	2	11-pin tube socket
(37)438-4	4	Phono plug
(38)438-29	1	11-pin plug
(39)440-1	2	11-pin plug cap

PART No.	PARTS Per Kit	DESCRIPTION
CABLE-WIRE-SLEEVING		
134-140	1	Cable assembly
343-7	1	Coaxial cable
344-50	1	Black hookup wire
344-52	1	Red hookup wire
346-1	1	Small sleeving
346-2	2	Large sleeving (clear)
KNOBS		
(40)462-7	1	Push-on
(41)462-106	1	11/16" diameter
(42)462-191	4	1-1/8" diameter
(43)462-210	1	2" diameter
(44)462-218	1	Lever
GENERAL		
69-34	1	Relay
73-1	4	Rubber grommet
(45)75-52	1	Slide switch insulator
85-69-9	1	Circuit board
(46)259-20	48	Terminal
(47)260-7	1	IF transformer mounting clip
(48)261-4	4	Small rubber foot
(49)261-9	2	Medium rubber foot
(50)261-21	2	Large rubber foot
407-99	1	Meter
(51)431-14	2	2-lug terminal strip
(52)435-1	1	11-pin plug mounting ring
(53)455-11	1	Split bushing
(54)455-52	1	Lever knob bushing
464-29-1	1	Plastic dial
490-1	1	Alignment tool
490-5	1	Nut starter*
597-308	1	Kit Builders Guide
597-260	1	Parts Order Form
391-34	1	Blue and white label
	1	Manual (See front cover for part number.)
		Solder

*See Page 3 of the Kit Builders Guide.

PART No.	PARTS Per Kit	DESCRIPTION
METAL PARTS		
(55) 204-576	1	Gimbal bracket
(56) 90-265	1	Cabinet
(57) 206-312	1	Final shield
(58) 204-182	1	Final shield mounting bracket
(59) 204-453	1	Pilot lamp mounting bracket
(60) 100-596-2	1	Chassis
(61) 100-43	1	Dial mounting plate
(62) 204-732	1	Switch lever mounting bracket
(63) 266-90	1	Switch lever
(64) 100-597	1	Front panel
HARDWARE		
#3 Hardware		
(65) 250-49	4	3-48 x 1/4" screw
(66) 252-1	4	3-48 nut
(67) 254-7	4	#3 lockwasher
#4 Hardware		
(68) 250-213	14	4-40 x 5/16" screw
(69) 250-273	20	4-40 x 3/8" screw
(70) 252-15	8	4-40 nut
(71) 252-89	20	4-40 push-on nut
(72) 254-9	14	#4 lockwasher

PART No.	PARTS Per Kit	DESCRIPTION
#6 Hardware		
(73) 250-170	9	#6 x 1/4" sheet metal screw
(74) 250-56	23	6-32 x 1/4" screw
(75) 250-89	4	6-32 x 3/8" screw
(76) 250-13	6	6-32 x 1" screw
(77) 250-27	2	6-32 x 2" screw
(78) 252-3	31	6-32 nut
(79) 253-2	2	#6 fiber shoulder washer
(80) 254-1	39	#6 lockwasher
(81) 255-5	4	#6 x 3/4" spacer
(82) 255-10	2	#6 x 1-1/2" spacer
(83) 259-1	5	#6 solder lug
#8 Hardware		
(84) 250-43	7	8-32 x 1/4" setscrew
(85) 253-9	6	#8 flat washer
#10 Hardware		
(86) 250-83	8	#10 x 1/2" sheet metal screw
(87) 250-54	2	10-32 x 5/8" screw
(88) 252-49	2	10-32 x 1-1/4" knurled nut
(89) 253-19	2	#10 flat washer
(90) 254-3	2	#10 lockwasher
(91) 255-44	2	#10 shoulder spacer
1/4" Control Hardware		
(92) 252-39	1	1/4-32 nut
(93) 253-39	1	1/4" flat washer
(94) 253-36	1	1/4" spring washer
(95) 254-14	1	1/4" lockwasher
3/8" Control Hardware		
(96) 252-7	2	3/8-32 nut
(97) 253-10	2	3/8" flat washer
(98) 254-5	2	3/8" lockwasher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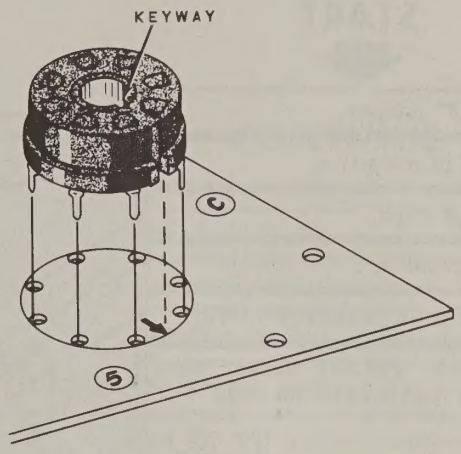
( ) Remove pins 8 and 9 from the other 12-pin tube socket.

( ) Install this socket at location V7. Solder all ten pins of the socket.

( ) Refer to Detail 1-1D, and install the 8-pin tube socket at the calibrator location. Align the keyway of the socket with the arrow printed on the circuit board, and solder all eight pins.

Use 1/2 watt resistors unless directed otherwise in a step. All resistors will be called out by only the resistance value (in Ω, KΩ, or megohms) and color code. Capacitors will be called out by only the capacitance value and type.

When a step calls for a "jumper," use the black hookup wire. Prepare the wire by cutting it to the specified length and remove 1/2" of insulation from each end of the wire.



Detail 1-1D

In steps requiring sleeving over a jumper wire or leads of a component, measure the length required directly from the circuit board. Always use the small sleeving unless the large sleeving is specified in a step.

Perform the steps on Pictorials 1-2 through 1-9.

START

( ) 1-5/8" jumper.

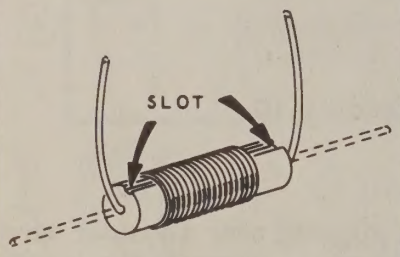
( ) 1300 pf mica.

( ) 310 pf mica.

( ) 360 pf mica.

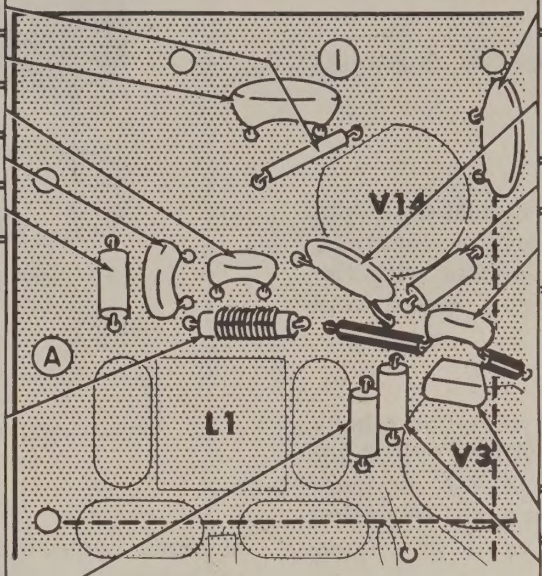
( ) 1000 Ω (brown-black-red).

( ) 15 μh (#45-51) choke. Bend each lead toward the slot.



( ) 4700 Ω (yellow-violet-red).

( ) Solder all connections and cut off excess leads.



BOARD SECTION 1A

CONTINUE

( ) .02 μfd disc.

( ) .005 μfd disc. NOTE: Do not use the .005 μfd 1.6 KV capacitors until they are called for specifically.

( ) 3300 Ω (orange-orange-red).

( ) 310 pf mica. Use sleeving on both leads.

NOTE: When installing Mylar capacitors having a banded end, position the banded end as marked on the circuit board. If no mark appears on the circuit board and/or capacitor, the capacitor can be installed either way.

( ) .1 μfd Mylar.

( ) 220 Ω (red-red-brown).

( ) Solder all connections and cut off excess leads.

PERFORM THE STEPS ON PICTORIAL 1-3.

PICTORIAL 1-2

START

( ) 220 Ω (red-red-brown).

( ) .047 μfd Mylar.

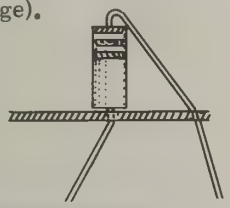
( ) .1 μfd Mylar.

( ) 1 megohm (brown-black-green).

( ) 22 megohm (red-red-blue).

( ) 47 KΩ (yellow-violet-orange).

( ) 12 KΩ 2 watt (brown-red-orange).



( ) 10 KΩ (brown-black-orange).

( ) 47 KΩ (yellow-violet-orange).

( ) Solder all connections and cut off excess leads.

( ) .005 μfd disc.

(✓) 100 KΩ (brown-black-yellow).

(✓) .005 μfd disc.

NOTE: Position the banded end of germanium diodes as shown.

(✓) Germanium diode. Use 1/4" of sleeving on each lead.

(✓) 220 Ω (red-red-brown).

(✓) 36 pf mica.

(✓) Germanium diode. Use 1/4" of sleeving on each lead.

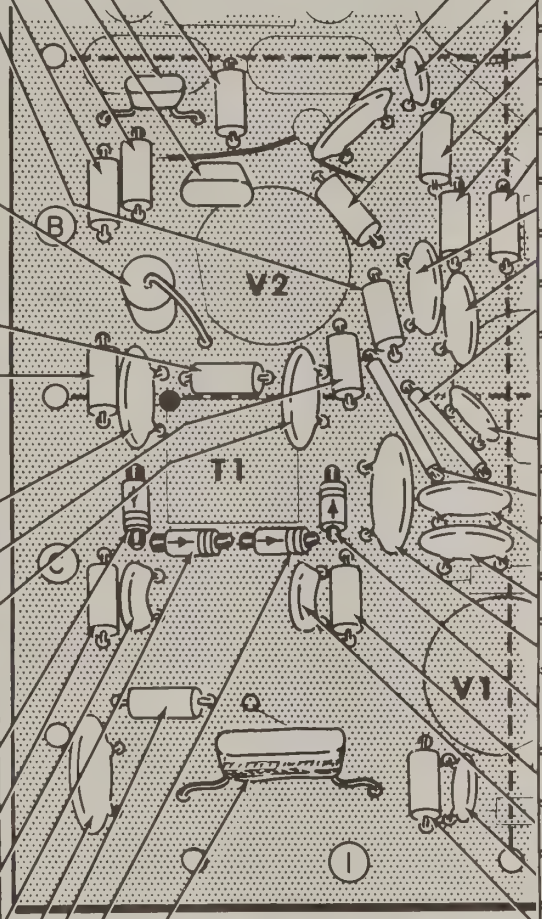
(✓) .02 μfd disc.

(✓) 1000 Ω (brown-black-red).

(✓) Germanium diode. Use 1/4" of sleeving on each lead.

(✓) .47 μfd Mylar. Be careful when bending the leads that they do not pull out of the capacitor.

(✓) Solder all connections and cut off excess leads.



BOARD SECTIONS 1B and 1C

PICTORIAL 1-3

CONTINUE

(✓) .005 μfd disc.

(✓) 18 pf disc.

(✓) 4700 Ω (yellow-violet-red).

(✓) 220 KΩ (red-red-yellow).

(✓) 47 KΩ (yellow-violet-orange).

(✓) 1 megohm (brown-black-green).

(✓) .02 μfd disc.

(✓) .02 μfd disc.

(✓) 1-3/4" jumper.

(✓) Solder all connections and cut off excess leads.

(✓) 500 pf disc.

(✓) 1-7/8" jumper.

(✓) .005 μfd disc.

(✓) .005 μfd disc.

(✓) .02 μfd disc.

(✓) Germanium diode. Use 1/4" of sleeving on each lead.

(✓) 220 Ω (red-red-brown).

(✓) 36 pf mica.

(✓) 500 pf disc.

(✓) 1000 Ω (brown-black-red).

(✓) Solder all connections and cut off excess leads.

PERFORM THE STEPS ON PICTORIAL 1-4.

START

( ) 360 pf mica. Connect only one lead (S-1).

( ) 1000 pf mica.

( ) 100 KΩ (brown-black-yellow).

( ) 10 KΩ (brown-black-orange).

( ) 47 KΩ (yellow-violet-orange).

( ) .005 μfd disc.

( ) 100 KΩ (brown-black-yellow).

( ) 18 pf disc.

( ) 2-1/4" jumper.

( ) 2" jumper.

( ) 1 megohm (brown-black-green).

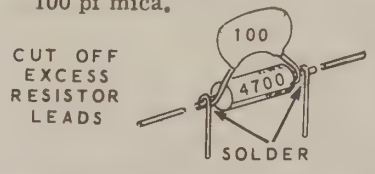
( ) Solder all connections and cut off excess leads.

( ) .02 μfd disc.

( ) 2-3/8" jumper.

( ) 1 megohm (brown-black-green).

( ) 4700 Ω (yellow-violet-red) and 100 pf mica.



( ) 220 KΩ (red-red-yellow). Use sleeving on one lead.

( ) .02 μfd disc.

( ) 1 megohm (brown-black-green).

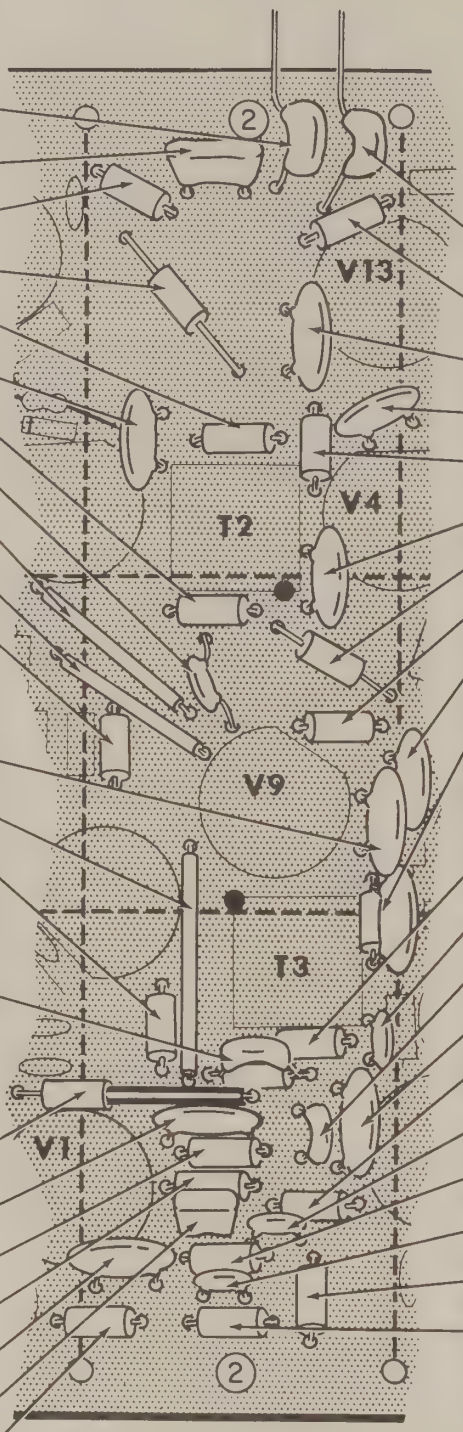
( ) 1 megohm (brown-black-green).

( ) .02 μfd disc.

( ) .1 μfd Mylar.

( ) 22 KΩ (red-red-orange).

( ) Solder all connections and cut off excess lead.



BOARD SECTIONS 2A, 2B, and 2C

CONTINUE

( ) 100 pf mica. Connect only one lead (S-1).

( ) 100 KΩ (brown-black-yellow).

( ) .02 μfd disc.

( ) .005 μfd disc.

( ) 330 Ω (orange-orange-brown).

( ) .02 μfd disc.

( ) 4700 Ω (yellow-violet-red).

( ) 4700 Ω (yellow-violet-red).

( ) .005 μfd disc.

( ) 2.2 megohm (red-red-green) and .02 μfd disc.

( ) Solder all connections and cut off excess lead.

( ) 220 KΩ (red-red-yellow).

( ) 18 pf disc.

( ) 36 pf mica.

( ) .02 μfd disc.

( ) 3300 Ω (orange-orange-red).

( ) 47 pf disc.

( ) 1000 Ω (brown-black-red).

( ) 500 pf disc.

( ) 10 KΩ (brown-black-orange).

( ) 100 KΩ (brown-black-yellow).

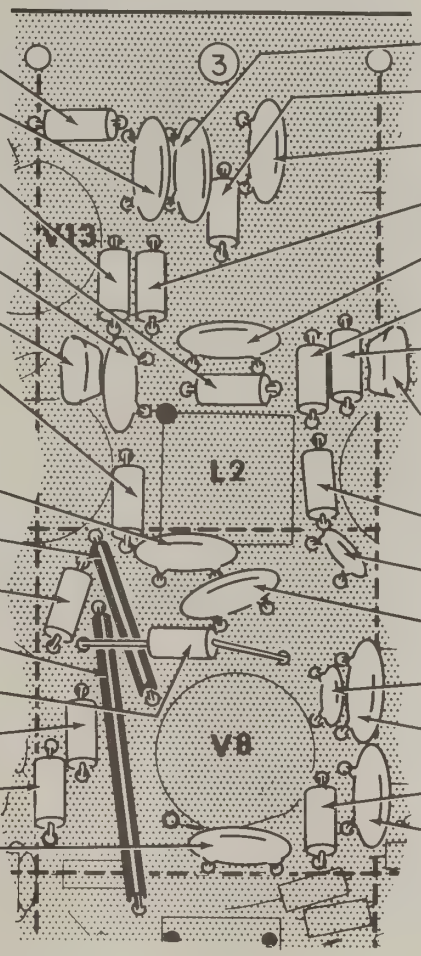
( ) Solder all connections and cut off excess leads.

PERFORM THE STEPS ON PICTORIAL 1-5.

PICTORIAL 1-4

START

- ( ) 10 KΩ (brown-black-orange).
- ( ) .02 µfd disc.
- ( ) 22 KΩ (red-red-orange).
- ( ) 47 KΩ (yellow-violet-orange).
- ( ) .005 µfd disc.
- ( ) .1 µfd Mylar.
- ( ) 100 KΩ (brown-black-yellow).
- ( ) Solder all connections and cut off excess leads.
- ( ) .02 µfd disc.
- ( ) 2" jumper. Use sleeving.
- ( ) 1000 Ω (brown-black-red).
- ( ) 2-7/8" jumper. Use sleeving.
- ( ) 1 megohm (brown-black-green).
- ( ) 1000 Ω (brown-black-red).
- ( ) 47 KΩ (yellow-violet-orange).
- ( ) .005 µfd disc.
- ( ) Solder all connections and cut off excess leads.



CONTINUE

- ( ) .02 µfd disc.
- ( ) 1000 Ω (brown-black-red).
- ( ) .02 µfd disc.
- ( ) 220 KΩ (red-red-yellow).
- ( ) .02 µfd disc.
- ( ) 6800 Ω (blue-gray-red).
- ( ) 150 Ω (brown-green-brown).
- ( ) Solder all connections and cut off excess leads.
- ( ) .1 µfd Mylar.
- ( ) 47 Ω (yellow-violet-black).
- ( ) 47 pf disc.
- ( ) .02 µfd disc.
- ( ) 47 pf disc.
- ( ) .005 µfd disc.
- ( ) 47 KΩ (yellow-violet-orange).
- ( ) .02 µfd disc.
- ( ) Solder all connections and cut off excess leads.

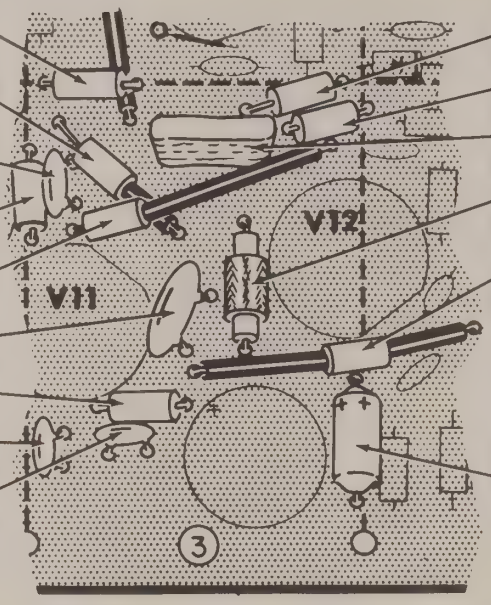
BOARD SECTIONS 3A and 3B

PERFORM THE STEPS ON PICTORIAL 1-6.

PICTORIAL 1-5

START

- (✓) 2.2 megohm (red-red-green).
- (✓) 1 megohm (brown-black-green). Use sleeving on one lead.
- (✓) 500 pf disc.
- (✓) 4700 Ω (yellow-violet-red).
- (✓) 47 KΩ (yellow-violet-orange). Use sleeving on one lead.
- (✓) .02 μfd disc.
- (✓) 22 KΩ (red-red-orange).
- (✓) 47 pf disc.
- (✓) 47 pf disc.
- (✓) Solder all connections and cut off excess leads.



CONTINUE

- (✓) 1 megohm (brown-black-green).
- (✓) 100 KΩ (brown-black-yellow).
- (✓) .47 μfd Mylar.
- (✓) 2 mh (#45-47) choke. Bend each lead toward the slot.
- (✓) 2.2 megohm (red-red-green). Use sleeving on both leads.

NOTE: When installing electrolytic capacitors, position the lead from the positive (+) end to the positive (+) marked hole in the circuit board.

- (✓) 10 μfd electrolytic capacitor. Note position of (+) end.
- (✓) Solder all connections and cut off excess leads.

BOARD SECTION 3C

PERFORM THE STEPS ON PICTORIAL 1-7.

PICTORIAL 1-6

START

( ) 2-1/2" jumper.

( ) 100 KΩ (brown-black-yellow).

( ) 47 KΩ (yellow-violet-orange).

( ) 22 KΩ (red-red-orange).

( ) 1300 pf mica.

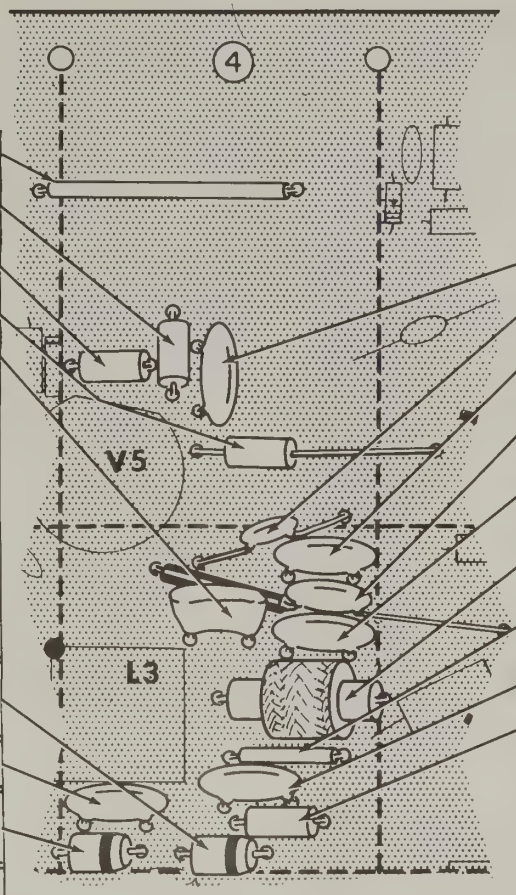
NOTE: When installing silicon diodes, the banded end should be placed as shown. The banded end is marked with a color end, color dot, or color band.

( ) Silicon diode. Note position of banded end.

( ) .02 µfd disc.

( ) Silicon diode. Note position of banded end.

( ) Solder all connections and cut off excess leads.



BOARD SECTIONS 4A and 4B

CONTINUE

( ) .005 µfd disc.

( ) 18 pf disc.

( ) .02 µfd disc.

( ) .005 µfd disc. Use sleeving on one lead.

( ) .02 µfd disc.

( ) 1 mh (#45-3) choke. Bend each lead toward the slot.

( ) 1-1/2" jumper.

( ) .02 µfd disc.

( ) 100 KΩ (brown-black-yellow).

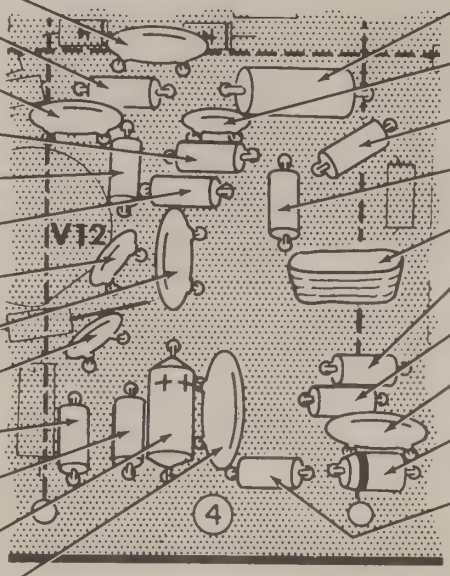
( ) Solder all connections and cut off excess leads.

PERFORM THE STEPS ON PICTORIAL 1-8.

PICTORIAL 1-7

START

( ) .02 µfd disc.
( ) 220 KΩ (red-red-yellow).
( ) .005 µfd disc.
( ) 1 megohm (brown-black-green).
( ) 47 KΩ (yellow-violet-orange).
( ) 100 KΩ (brown-black-yellow).
( ) 200 pf disc.
( ) .005 µfd disc.
( ) 500 pf disc.
( ) 100 Ω (brown-black-brown).
( ) 3300 Ω (orange-orange-red).
( ) 10 µfd electrolytic. Note position of (+) end.
( ) .005 µfd 1.6 KV disc.
( ) Solder all connections and cut off excess leads.



BOARD SECTION 4C

CONTINUE

( ) 12 KΩ 2 watt (brown-red-orange).
( ) 500 pf disc.
( ) 2.2 megohm (red-red-green).
( ) 10 KΩ (brown-black-orange).
( ) .47 µfd Mylar.
( ) 220 KΩ (red-red-yellow).
( ) 100 KΩ (brown-black-yellow).
( ) .02 µfd disc.
( ) Silicon diode. Note position of banded end.
( ) 47 KΩ (yellow-violet-orange).
( ) Solder all connections and cut off excess leads.

PERFORM THE STEPS ON PICTORIAL 1-9.

PICTORIAL 1-8

START

( ) 220 Ω (red-red-brown).

( ) .005 µfd disc.

( ) Germanium diode. Use 1/4" of sleeving on each lead.

( ) 10 KΩ (brown-black-orange).

( ) 18 pf disc.

( ) 100 Ω (brown-black-brown).

( ) .005 µfd disc.

( ) 6800 Ω 2 watt (blue-gray-red).

( ) Solder all connections and cut off excess leads.

( ) 18 pf disc.

( ) .005 µfd disc.

( ) 100 Ω (brown-black-brown).

( ) 2.2 megohm (red-red-green).

( ) Silicon diode. Note position of banded end.

( ) 47 KΩ (yellow-violet-orange).

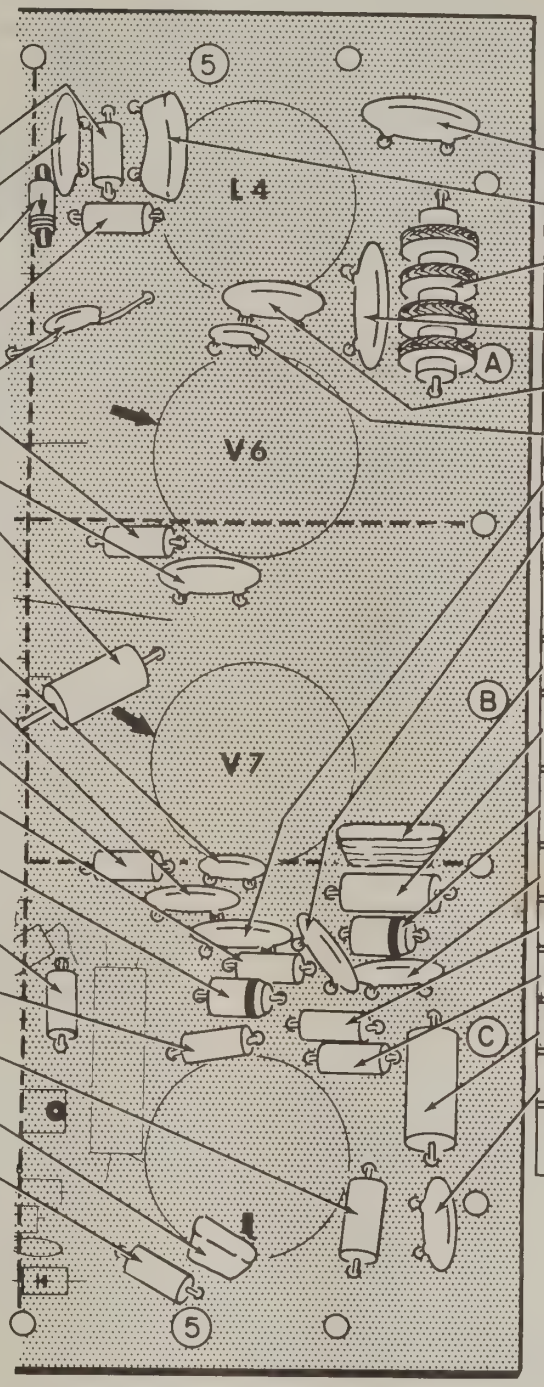
( ) 10 KΩ (brown-black-orange).

( ) 100 KΩ 1 watt (brown-black-yellow).

( ) .1 µfd Mylar.

( ) 1000 Ω (brown-black-red).

( ) Solder all connections and cut off excess leads.



CONTINUE

( ) .005 µfd 1.6 KV disc.

( ) 1000 pf mica.

( ) 1.1 mh (#45-4) choke. Bend each lead toward the slot.

( ) .005 µfd 1.6 KV disc.

( ) .02 µfd disc.

( ) 18 pf disc.

( ) .02 µfd disc.

( ) .005 µfd disc.

( ) Solder all connections and cut off excess leads.

( ) .22 µfd Mylar.

( ) .33 Ω 2 watt (orange-orange-silver).

( ) Silicon diode. Note position of banded end.

( ) .005 µfd disc.

( ) 10 KΩ (brown-black-orange).

( ) 10 KΩ (brown-black-orange).

( ) 20 Ω 2 watt (red-black-black).

( ) .005 µfd disc.

( ) Solder all connections and cut off excess leads.

PROCEED TO PAGE 16.

BOARD SECTIONS 5A, 5B, and 5C

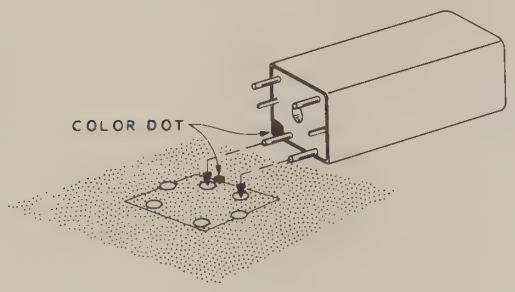
PICTORIAL 1-9

Refer to Pictorial 1-10 (fold-out from Page 6) for the following steps.

NOTE: Each of the following parts will be easier to mount if it is soldered right after it is installed on the circuit board. When mounting each of the following coils and transformers, be sure to align its color dot with the dot printed on the circuit board.

CAUTION: Do not turn any of the adjusting slugs of the coils or transformers, as they are preadjusted at the factory.

( ) Refer to Detail 1-10A, and install the three #52-63 transformers at locations T1, T2, and T3.



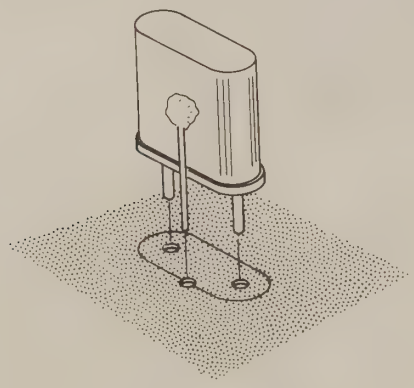
Detail 1-10A

( ) Install coil #40-509 at L1.

( ) Install coil #40-516 at location L2.

( ) Install coil #40-513 at location L3.

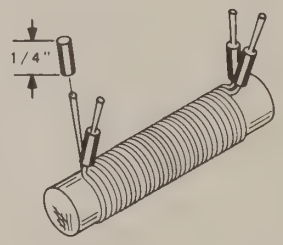
( ) Refer to Detail 1-10B, and install the two #404-191 crystals at their proper locations in section 1A.



Detail 1-10B

( ) In a like manner, install the two #404-192 crystals in their proper locations in section 1A.

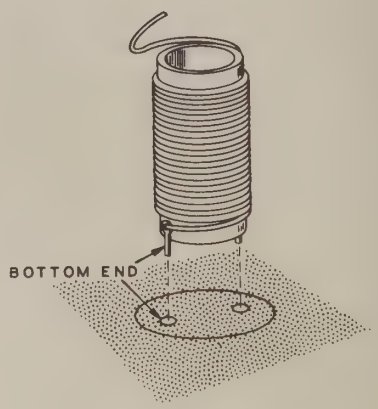
( ) Refer to Detail 1-10C, and place 1/4" lengths of sleeving on each of the four leads of bifilar choke #45-58.



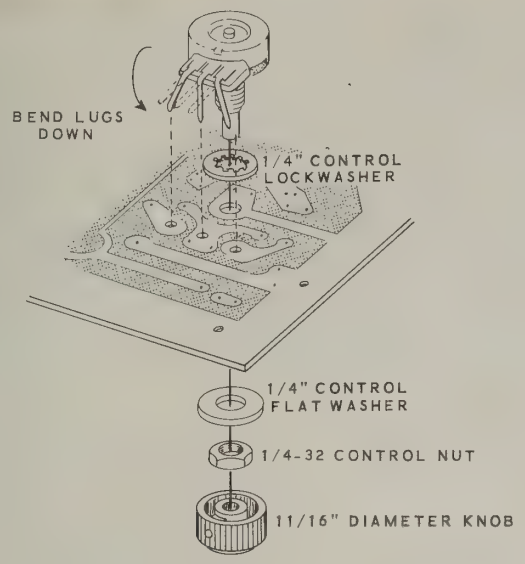
Detail 1-10C

( ) Install this choke at its proper location in section 5C. The leads can be placed in either circuit board hole at the ends of the choke. Press the choke down below the top of the calibrator socket.

( ) Refer to Detail 1-10D, and mount final coil #40-510 at location L4. Be sure to position the bottom end of the coil winding as shown. The coil lead will be connected later.



Detail 1-10D



Detail 1-10E

( ) Refer to Detail 1-10E, and bend the lugs of the 200 Ω bushing-mount control (#10-130) as shown.

( ) Install this control at the Carrier Null location in section 1C. Use a 1/4" control lockwasher, 1/4" control flat washer, and a 1/4-32 control nut. Before soldering, be sure the control lugs are aligned with the proper foils.

( ) Install the 11/16" diameter knob on this control. If necessary, push the two diodes apart so the knob will turn freely.

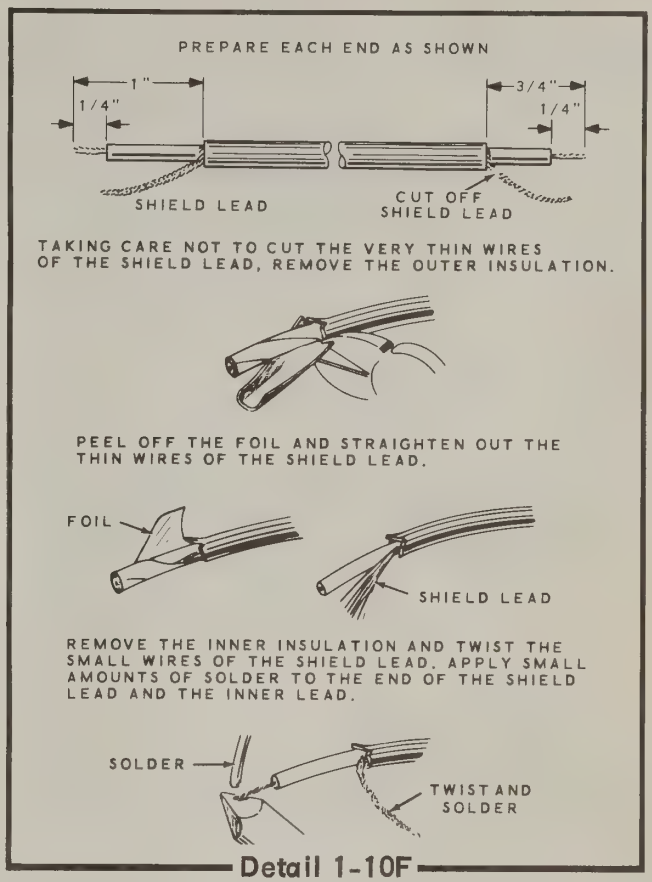
( ) Place 3/4" lengths of sleeving on the leads of the NE2 neon lamp. Install the lamp at NE in section 1B.

( ) Install the 20 μfd vertical electrolytic capacitor in section 3C. Note the position of the positive (+) marking.

( ) Refer to Detail 1-10F, and prepare the ends of a 5" length of coaxial cable.

( ) At the end of this cable with no shield, connect the inner lead in hole A in section 3C.

( ) Connect the other end of this cable at A in section 1C. The inner lead goes in the hole with the circle around it.


PREPARE EACH END AS SHOWN
1"
1/4"
3/4"
1/4"
SHIELD LEAD
CUT OFF SHIELD LEAD
TAKING CARE NOT TO CUT THE VERY THIN WIRES OF THE SHIELD LEAD, REMOVE THE OUTER INSULATION.
PEEL OFF THE FOIL AND STRAIGHTEN OUT THE THIN WIRES OF THE SHIELD LEAD.
FOIL
SHIELD LEAD
REMOVE THE INNER INSULATION AND TWIST THE SMALL WIRES OF THE SHIELD LEAD. APPLY SMALL AMOUNTS OF SOLDER TO THE END OF THE SHIELD LEAD AND THE INNER LEAD.
SOLDER
TWIST AND SOLDER

Detail 1-10F

( ) Prepare the ends of a 6-1/2" coaxial cable as before.

( ) At the end of this cable with no shield, connect the inner lead in hole C in section 1A.

( ) Connect the other end of this cable at C in section 3B. The inner lead goes to the hole with the circle around it. Use a 3/4" length of sleeving on the shield lead. Position the cable as shown in the Pictorial.

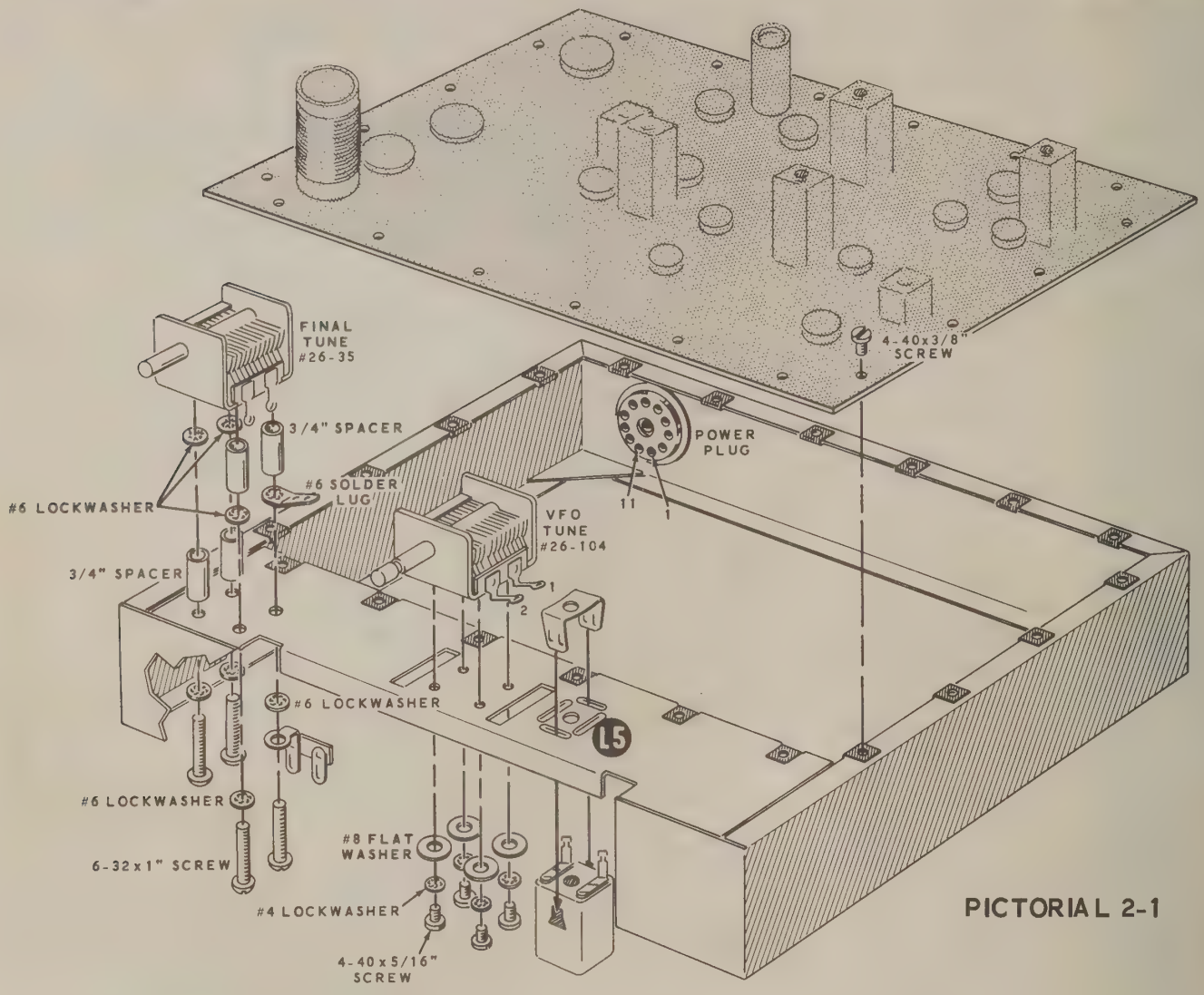
( ) Prepare the ends of a 6" length of coaxial cable.

( ) At the end of this cable with no shield, connect the inner lead in hole B in section 3B.

( ) Connect the other end of the cable at B in section 1B. The inner lead goes to the hole with the circle around it.

This completes the mounting of all components on the lettered side of the circuit board. Check to see that all connections are soldered and that there are no solder bridges between foils.

Set the circuit board aside until called for later.

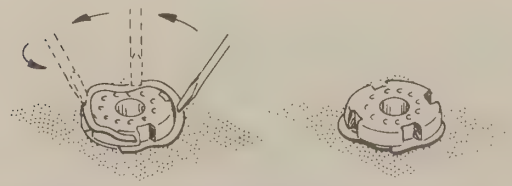


PICTORIAL 2-1

PARTS MOUNTING-CHASSIS

Refer to Pictorial 2-1 for the following steps.

( ) Refer to Detail 2-1A, and mount the 11-pin plug at the Power Plug location using the 11-pin plug mounting ring. Position pins 1 and 11 as shown.

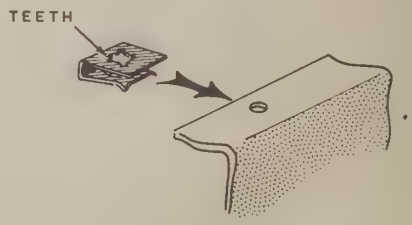


HOLD THE PLUG IN THE CHASSIS HOLE. PLACE ONE END OF THE RING INTO THE GROOVE OF THE PLUG. USING A SCEWDRIVER, PRESS THE RING INTO THE GROOVE AROUND THE PLUG.

Detail 2-1A

( ) Install VFO coil #52-25 at location L5, using the transformer mounting clip. Position the coil as shown.

( ) Refer to Detail 2-1B, and install 4-40 push-on nuts at the twenty circuit board mounting holes on the chassis. Be sure to position the teeth of the nuts upward as shown.



Detail 2-1B

( ) Install the circuit board on the chassis using 4-40 x 3/8" screws. Position the board as shown. Be sure not to overtighten the screws, as the threads can be stripped from the nuts. CAUTION: Be sure the push-on nut indicated by the arrow in Pictorial 2-2 is not shorting to the foil that is outlined.

NOTE: Keep the plates of variable capacitors fully meshed (closed) at all times during the assembly of the kit, to prevent them from being damaged.

( ) Locate double-section variable capacitor #26-104 and bend lugs 1 and 2 up as shown.

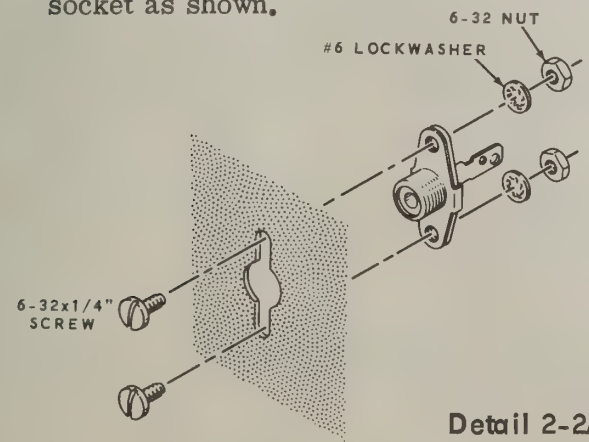
( ) Mount this capacitor at the VFO Tune location using 4-40 x 5/16" screws, #4 lockwashers, and #8 flat washers. Position the capacitor back against the circuit board.

( ) Mount single-section variable capacitor #26-35 at the Final Tune location, with a #6 solder lug and a 2-lug terminal strip. Use 6-32 x 1" screws, #6 x 3/4" spacers, and #6 lockwashers.

Refer to Pictorial 2-2 (fold-out from Page 19) for the following steps.

NOTE: When hardware is called for in a step, only the screw size will be given. For instance, if "6-32 x 1/4" hardware" is call for, it means that a 6-32 x 1/4" screw, one or more #6 lockwashers, and a 6-32 nut should be used. The Detail referred to in the step will show the proper number of lockwashers to use.

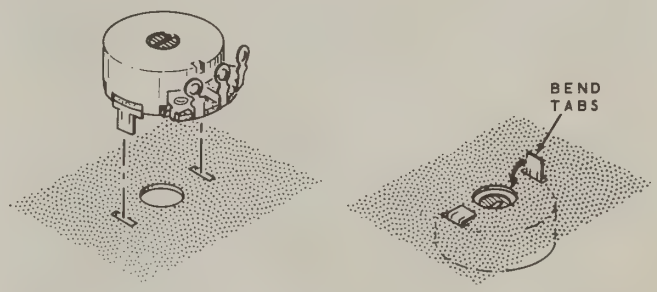
( ) Refer to Detail 2-2A, and install a phono socket at the Receiver (RCVR) location. Use 6-32 x 1/4" hardware. Position the socket as shown.



Detail 2-2A

( ) In a like manner, install phono sockets at the Antenna (ANT), ALC, and Speaker (SPKR) locations. Use 6-32 x 1/4" hardware. Position each socket as shown.

( ) Refer to Detail 2-2B, and install 100 KΩ tab-mount control #10-58 at the Tune Level location. Bend the tabs inward towards the center of the control.



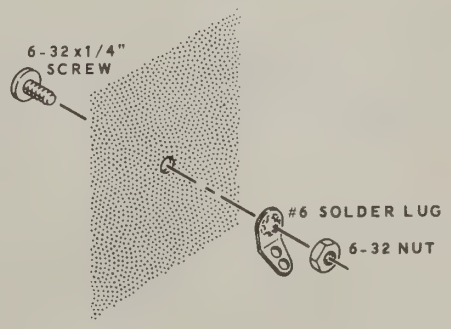
Detail 2-2B

( ) In a like manner, install 1 megohm tab-mount controls #10-127 at the VOX Sensitivity (VOX SENS) and VOX Delay locations. Bend the tabs as before.

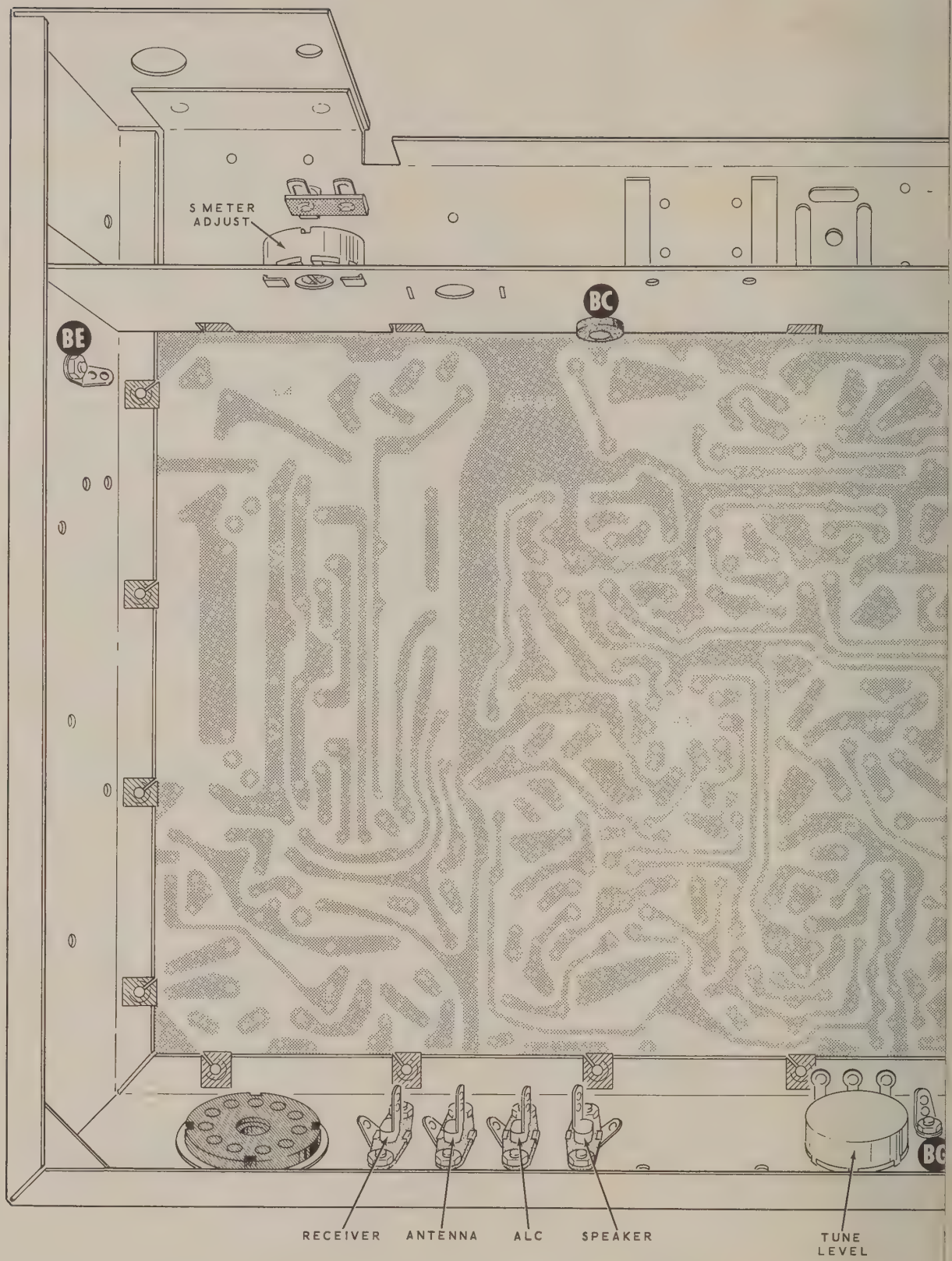
( ) Install 10 KΩ tab-mount controls #10-57 at the S Meter Adjust and Bias Adjust locations.

( ) Refer to Detail 2-2C, and install #6 solder lugs at locations BE and BG. Use 6-32 x 1/4" screws and 6-32 nuts.

( ) Install rubber grommets in the square holes at locations BC and BD.



Detail 2-2C



PICTORIAL 2-2

HEATH
Schlumberger

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022
PHONE 616-983-3961 TWX 616-983-3897

May 17, 1973

IMPORTANT NOTICE

Please make the following change in your Manual before starting to assemble your Transistorized DC Power Supply.

Page 2 – Refer to the second part listed under "Capacitors," #25-254, and cross out the word "nonpolarized."

Page 12 – Locate the second step in the right-hand column that starts "( ) Connect a 4 μF nonpolarized. . ." Change this step to read:

( ) Connect the lead at the positive (+) marked end of a 4 μF electrolytic capacitor to lug 1 of transistor AE (NS). Connect the other lead to lug 1 of resistor AH (NS).

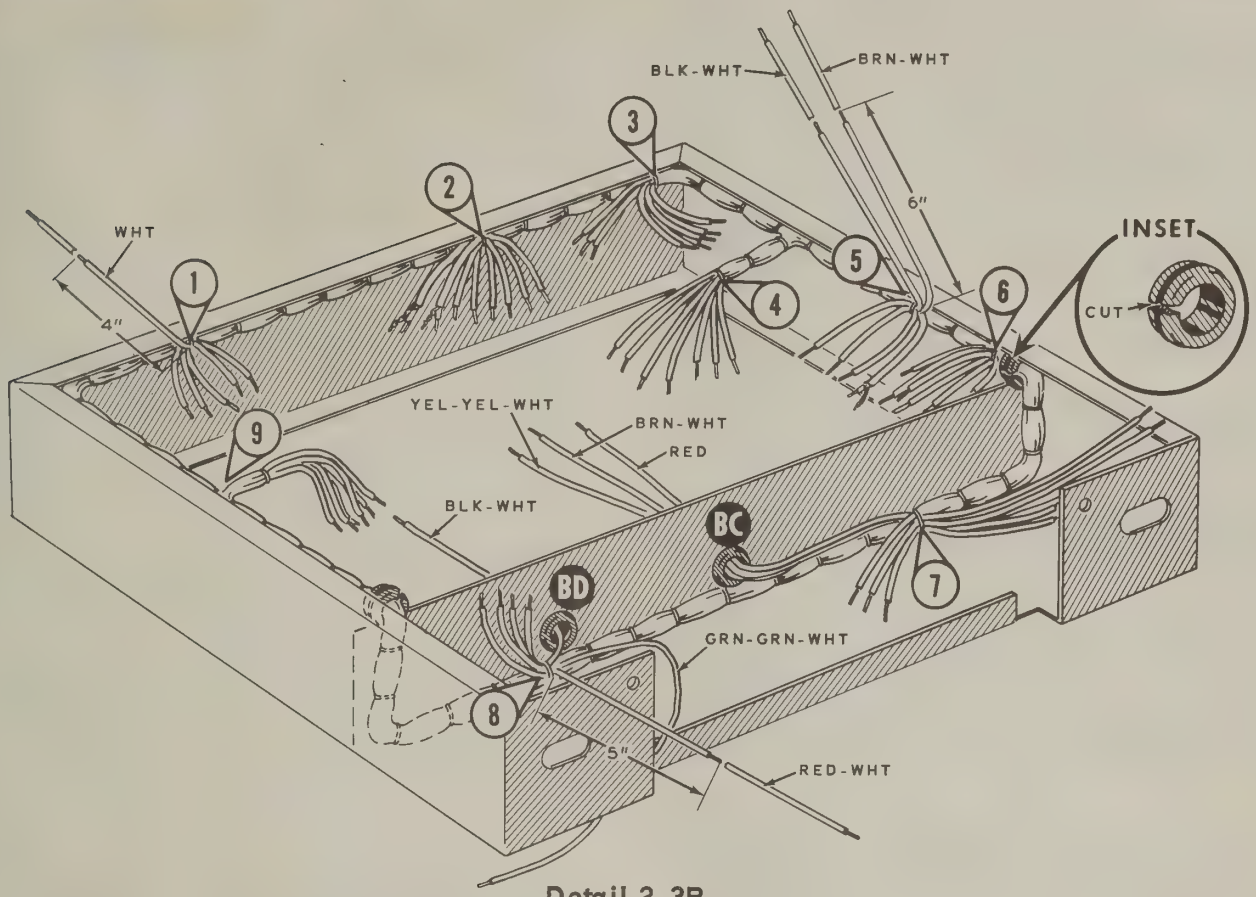
– Change the last step in the right-hand column to read:

( ) Connect the lead at the positive (+) marked end of a 4 μF electrolytic capacitor to lug 1 of transistor CE (S-2). Connect the other lead to lug 2 of resistor CB (NS).

Thank you,

HEATH COMPANY

HP-13B/595-1415-01
591-1215



Detail 2-3B

NOTE: The terminals in the circuit board are numbered to correspond to the wire colors of the cable assembly. The color-number relationship is based on the resistor color code; brown = 1, red = 2, orange = 3 etc. For instance, a red wire will go to a #2 terminal, and an orange wire to a #3 terminal, etc. Wires with a single color stripe and a white background are in the 10 series numbers; a black-white wire will go to a #10 terminal, and orange-white wire to a #13 terminal, etc. Wires with two like color stripes and a white background are in the 20 series numbers; a green-green-white wire would go to a #25 terminal, a blue-blue-white wire to a #26 terminal, etc.

The stripped ends of the cable assembly wires are correct for connecting to the circuit board terminals, but are too long for control and switch lugs. Cut the stripped end of each of these wires to 1/4" when connecting them to a control or switch lug.

Connect the wires from BO#1 of the cable assembly as follows:

NOTE: Even though some of the cable assembly wires may be too long, it is not recommended that you shorten the wires. Any excess wire should be positioned back along the main trunk of the cable assembly.

( ) Green to lug 3 of the VOX Delay control (S-1).

( ) Black-black-white to lug 2 of the VOX Delay control (S-1).

( ) Blue to lug 2 of the VOX Sensitivity control (S-1).

( ) White to lug 1 of the Tune Level control (S-2).

The coaxial cables will be connected later.

Connect the wires from BO#2 to the circuit board as follows:

( ) Violet-violet-white to terminal 27 section 3C (S-1). Be sure not to use the violet-white wire.

( ) Blue to terminal 6 section 4C (S-1).

( ) Violet-white to terminal 17 section 4C (S-1).

( ) Orange-orange-white to terminal 23 section 4C (S-1).

NOTE: There are only three coaxial cable types in the cable assembly. One has no color marking (paint, tape, or color stripe); this one will be referred to as the "black coaxial cable." Another cable, which has a red marking, will be referred to as the "red coaxial cable." The remaining cable has two inner leads instead of one, and will be referred to as the "2-wire coaxial cable."

( ) Apply very small amounts of solder to the end of the inner lead of the black and red coaxial cables; this will hold the small wire strands together.

Connect the remaining wires from BO#2 as follows:

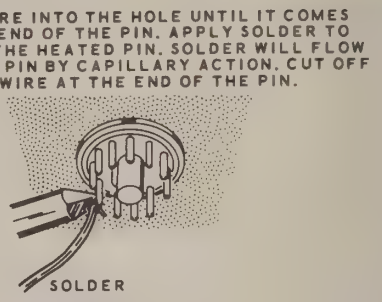
( ) Red coaxial cable: inner lead to lug 2 (NS) and the shield to lug 1 (NS) of the Receiver socket.

( ) Black coaxial cable: inner lead to lug 2 (S-1) and the shield to lug 1 (S-1) of the Antenna socket.

( ) Both violet to lug 2 of the ALC socket (S-2).

The 2-wire coaxial cable will be connected later.

NOTE: Refer to Detail 2-3C for soldering of the pins of the Power plug.


PUSH THE WIRE INTO THE HOLE UNTIL IT COMES OUT OF THE END OF THE PIN. APPLY SOLDER TO THE TIP OF THE HEATED PIN. SOLDER WILL FLOW UP INTO THE PIN BY CAPILLARY ACTION. CUT OFF THE EXCESS WIRE AT THE END OF THE PIN.
SOLDER

Detail 2-3C

Connect the wires from BO#3 to the Power plug as follows:

( ) Yellow-white to pin 11 (NS).

( ) Either gray-white to pin 10 (S-1).

( ) Other gray-white to pin 9 (S-1).

( ) Both black-white to pin 6 (NS).

( ) Red-red-white to pin 4 (S-1).

( ) Both brown-white to pin 2 (NS).

Connect the remaining wires from BO#3 to the circuit board as follows:

( ) Brown to terminal 1 section 5C (S-1).

( ) Blue-white to terminal 16 section 5C (S-1).

( ) One end of a 3-1/2" red wire and the red wire from BO#3 to terminal 2 section 5C (S-2). Connect the free end of this wire to pin 3 of the Power plug (NS).

Connect the wires from BO#4 to the circuit board as follows:

NOTE: In the following six steps, do not position the wires against the chassis. The audio output transformer will be mounted under these wires later.

( ) Green-green-white to terminal 25 section 5C (S-1).

( ) Brown-brown-white to terminal 21 section 5C (S-1).

( ) Green to terminal 5 section 5C (S-1).

( ) Both red to terminal 2 section 5C (S-2).

( ) Violet to terminal 7 section 4C (S-1).

( ) Orange to terminal 3 section 4B (S-1).

The wires from BO#5 will be connected later.

( ) Connect the red-red-white wire from BO#6 to terminal 22 section 5A of the circuit board (S-1).

The remaining wires from BO#6 will be connected later.

Connect the wires from BO#7 that pass through grommet BC as follows:

( ) Connect one end of a 4-1/2" red wire and the red wire extending from grommet BC to terminal 2 section 3A of the circuit board (S-2). Pass the free end of the wire through grommet BC for connection later.

( ) Connect one end of an 11-1/2" brown-white wire and the brown-white wire extending from grommet BC to terminal 11 section 3A of the circuit board (S-2). Pass the free end of the wire through grommet BC and along the chassis partition to the top of the chassis as shown. This end of the wire will be connected later.

( ) Connect the yellow-yellow-white wire extending from grommet BC to terminal 24 section 4A of the circuit board (S-1).

The remaining wires from BO#7 will be connected later.

( ) Connect one end of a 7-1/2" black-white wire and the black-white wire (from BO#8) extending from grommet BD to terminal 10 section 1A (S-2). Pass the free end of the wire through grommet BD and to the top of the chassis for connection later.

The remaining wires from BO#8 will be connected later.

Connect the wires from BO#9 to the circuit board as follows:

( ) Yellow to terminal 4 section 1B (S-1).

( ) Violet to terminal 7 section 1B (S-1).

( ) Black-black-white to terminal 20 section 1B (S-1).

( ) Green-white to terminal 15 section 1B (S-1).

( ) Orange-white to terminal 13 section 1B (S-1).

( ) Blue-blue-white to terminal 26 section 1B (S-1).

( ) Gray to terminal 8 section 2C (S-1).

( ) Gray-gray-white to terminal 28 section 1C (S-1).

( ) Brown to terminal 1 section 1C (S-1).

( ) Connect a 3-1/4" red wire between terminal 2 section 3B (S-1) and terminal 2 section 1B (NS).

( ) Connect the red wire from BO#9 to terminal 2 section 1B (S-2).

NOTE: There are no holes in the circuit board for the wire to be installed in the next step. Solder the ends of the wire directly to the foil.

( ) Remove 1/4" of insulation from both ends of a 2-1/4" black wire. Connect this wire between the two foils lettered D in section 3B, as shown in the inset drawing. Solder each end of the wire to the foil and position the wire approximately 1/4" above the circuit board.

( ) Connect a 1/4" bare wire (cut off resistor lead) between the two indicated foils in section 2A. These are the foils at pins 5 and 6 of tube socket V14. Solder the wire directly to the foils.

Refer to Pictorial 2-4 (fold-out from Page 27) for the following steps.

( ) Connect a 220 KΩ (red-red-yellow) resistor from lug 1 of the VOX Delay control (S-1) to lug 3 of the VOX Sensitivity control (S-2).

Connect the leads of the 2-wire coaxial cable from BO#1 as follows:

( ) Pass the shield lead through solder lug BG (S-3) and through lug 3 (NS) to lug 2 (S-1) of the Tune Level control.

( ) Connect the red lead to terminal L section 2C (S-1) and the black lead to terminal M section 1C (S-1) of the circuit board.

( ) Connect a 2-1/2" black wire from lug 1 of the VOX Sensitivty control (S-1) to terminal H section 2C (S-1).

( ) Also at BO#1, connect the black coaxial cable inner lead to terminal K section 2C of the circuit board (S-1) and the shield to lug 3 of the Tune Level control (S-3).

Connect the 2-wire coaxial cable at BO#2 as follows:

( ) Red lead to terminal Y section 4C (S-1) and the black lead to terminal G section 3C (S-1) of the circuit board.

( ) Shield lead to lug 2 of the Speaker socket (S-1).

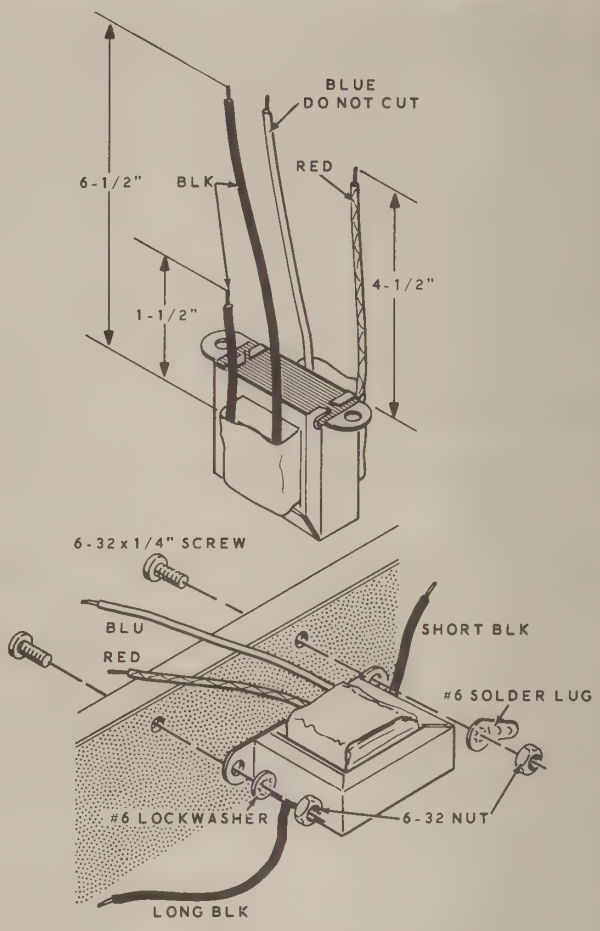
( ) Connect a 3-1/4" brown-white wire from terminal 11 section 5C of the circuit board (S-1) to pin 2 of the Power plug (S-3).

( ) Connect a 2-1/4" black-white wire from terminal 10 section 5C of the circuit board (S-1) to pin 6 of the Power plug (S-3).

( ) Connect a 2-3/4" black wire between pins 5 (NS) and 7 (S-1) of the Power plug.

( ) Connect a 2" black wire from pin 5 of the Power plug (S-2) to lug 1 (ground) of the Receiver socket (NS).

( ) Connect a 6-1/2" black wire from pin 1 of the Power plug (S-1) to terminal U section 4C of the circuit board (S-1).



Detail 2-4A

( ) Refer to Detail 2-4A, and cut the leads of output transformer #51-55 to the lengths shown. Measure the leads from where they come out of the transformer. Do not cut the blue lead. Remove 1/4" insulation from the end of each black lead, and 1/2" insulation from the red lead.

( ) Mount the output transformer at T4 with a #6 solder lug. Use 6-32 x 1/4" hardware. Do not pinch any wires between the chassis and transformer.

Connect the wires of transformer T4 as follows:

( ) Short black to solder lug BF (NS).

( ) Long black to lug 1 of the Speaker socket (S-1).

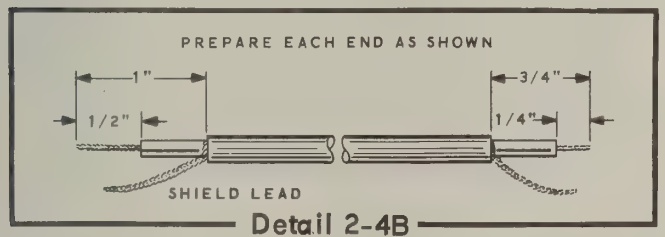
( ) Red to pin 3 of the Power plug (S-2).

( ) Blue to terminal P section 4C of the circuit board (S-1).

( ) Connect a .005 μfd disc capacitor from pin 11 of the Power plug (S-2) to lug 1 of the Receiver socket (NS).

( ) Now, check to see that all the wires connected to the Power plug are soldered. This can be done by pulling on each wire with a pair of long-nose pliers from the inside of the chassis. Pin 8 of the Power plug is not used.

( ) Refer to Detail 2-4B, and prepare the ends of a 4-3/4" length of coaxial cable.



Detail 2-4B

( ) At the end of this coaxial cable with the most insulation removed, connect the inner lead to terminal E (S-1) and the shield to terminal F (S-1) section 4B of the circuit board.

( ) At the other end of this cable, connect the inner lead to lug 2 (NS) and the shield to lug 1 (S-4) of the Receiver socket.

( ) Connect a 2-1/2" black wire from lug 2 of the Receiver socket (S-3) to terminal S section 5C of the circuit board (S-1).

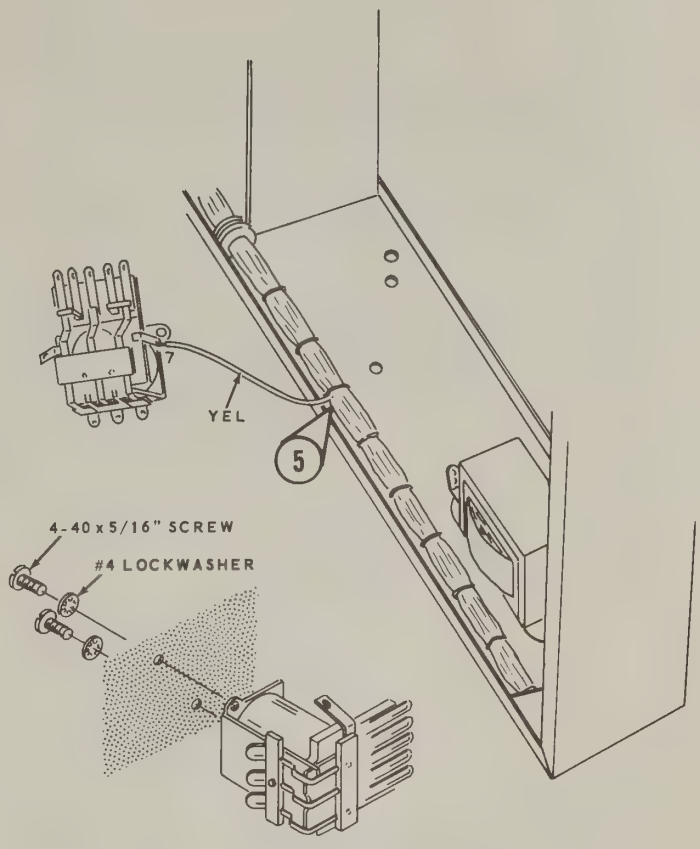
Refer to Detail 2-4C for the following steps.

( ) Connect the yellow wire from BO#5 to lug 7 (S-1) of relay #69-34.

( ) Mount the relay to the chassis using 4-40 x 5/16" screws and #4 lockwashers. Do not pinch any wires between the chassis and relay. Handle the relay carefully so you do not bend any of its contacts.

Refer to Pictorial 2-4 for the following steps.

( ) Pass one lead of a 330 Ω (orange-orange-brown) resistor through solder lug BF (NS) to lug 9 of the relay (S-1). Connect the other lead of this resistor to lug 8 of the relay (S-1).



Detail 2-4C

Connect the wires from BO#5 of the cable assembly to the relay as follows:

( ) Black coaxial cable: inner lead to lug 10 (S-1) and the shield to solder lug BF (S-4).

( ) Both red to lug 6 (S-2).

( ) Twist together the black-white and brown-white wires from BO#5 to form a twisted pair. Connect the brown-white wire to terminal 11 section 4B (S-1) and the black-white to terminal 10 section 3B (S-1) of the circuit board.

Connect the wires from BO#6 to the relay as follows:

( ) Red coaxial cable: inner lead to lug 4 (S-1) and the shield to solder lug BE (S-1).

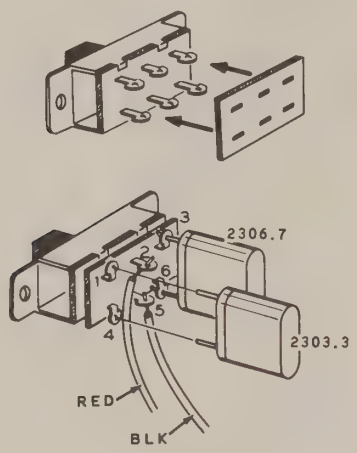
( ) Yellow-white to lug 3 (S-1).

( ) Orange to lug 2 (S-1).

( ) Both brown to lug 1 (S-2).

( ) Connect a 2-1/4" black wire from lug 5 of the relay (S-1) to terminal J of the circuit board (S-1).

Refer to Detail 2-4D for the following steps.



Detail 2-4D

( ) Position the slide switch insulator over the lugs of a DPDT slide switch.

( ) Bend lugs 1, 3, 4, and 6 of the switch as shown.

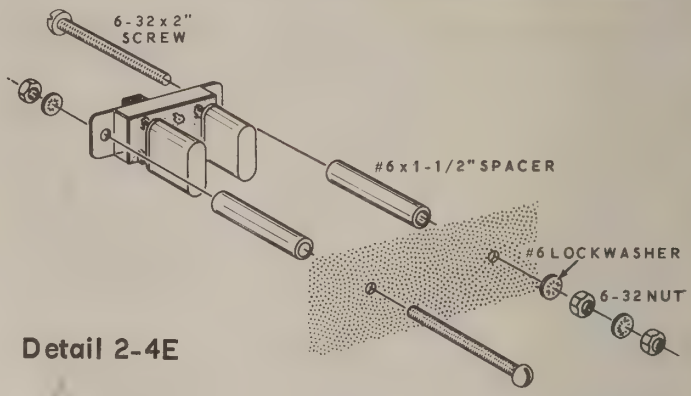
( ) Connect one end of a 3" red wire to lug 2 of the switch (S-1). The other end of this wire will be connected later.

( ) Connect one end of a 3" black wire to lug 5 of the switch (S-1). The other end of this wire will be connected later.

( ) Connect the 2303.3 kHz crystal (#404-196) between lugs 1 (S-1) and 4 (S-1) of this switch. Position the pins of the crystal into the holes in the lugs of the switch.

( ) In a like manner, connect the 2306.7 kHz crystal (#404-197) between lugs 3 (S-1) and 6 (S-1) of this switch.

NOTE: Be careful not to pinch any of the harness wires between the crystals and the chassis in the next step.



Detail 2-4E

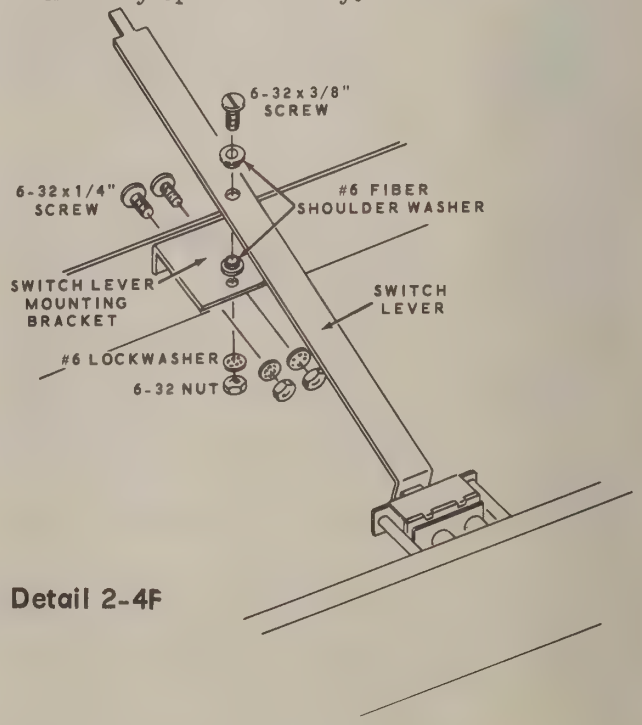
( ) Refer to Detail 2-4E, and mount the Sideband switch assembly on the chassis. Use 6-32 x 2" hardware and #6 x 1-1/2" spacers. Be sure to position the wires from the switch toward the circuit board as shown in Pictorial 2-4.

Refer to Detail 2-4F for the following steps.

( ) Mount the switch lever mounting bracket on the chassis partition. Use 6-32 x 1/4" hardware.

( ) Fit the slotted end of the switch lever over the knob on the Sideband switch.

( ) Secure the switch lever to the switch lever mounting bracket with 6-32 x 3/8" hardware and two #6 fiber shoulder washers. Check the operation of the lever and switch to see that they operate freely.



Detail 2-4F

Refer to Pictorial 2-4 for the following steps.

( ) Connect the free end of the red wire coming from lug 2 of the Sideband switch, to terminal R section 2C on the circuit board (S-1).

( ) Connect the free end of the black wire coming from lug 5 of the Sideband switch, to terminal Q section 2C on the circuit board (S-1).

FUNCTION SWITCH WIRING

Refer to Pictorial 2-5 for the following steps.

( ) Locate the 5-position rotary with snap switch (#63-427). Position the switch as shown. Note that the color dot is between lugs 1 and 12 of the wafer on this (Function) switch.

( ) Connect one end of a 5-1/2" red wire to lug 10 of the Function switch (S-1). Position the other end of the wire over the front edge of the chassis for connection later.

( ) Connect one end of a 4-1/2" red-white wire to lug 6 of the Function switch (NS). Position the other end of the wire over the front edge of the chassis for connection later.

Connect the wires from BO#8 to the Function switch as follows:

( ) Red-white to lug 6 (S-2).

( ) Both green-white to lug 5 (S-2). Do not use the green-green-white wire.

( ) Blue-blue-white to lug 4 (S-1). Do not use the blue-white wire.

( ) White to lug 2 (S-1).

( ) Orange-white to lug 9 (S-1). Do not use the orange-orange-white wire.

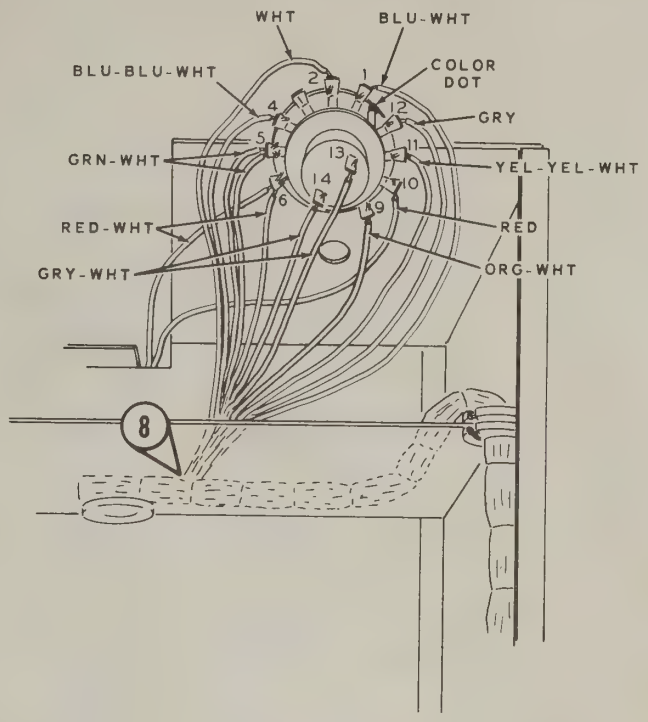
( ) Yellow-yellow-white to lug 11 (S-1).

( ) Gray to lug 12 (S-1).

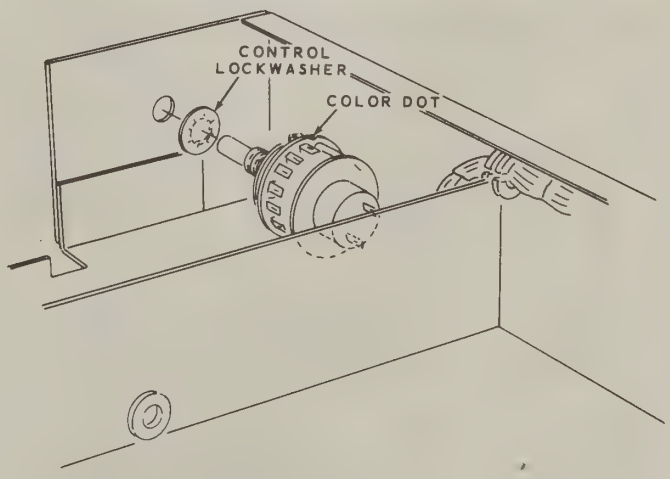
( ) Blue-white to lug 1 (S-1).

( ) Either gray-white to lug 14 (S-1).

( ) Other gray-white to lug 13 (S-1).



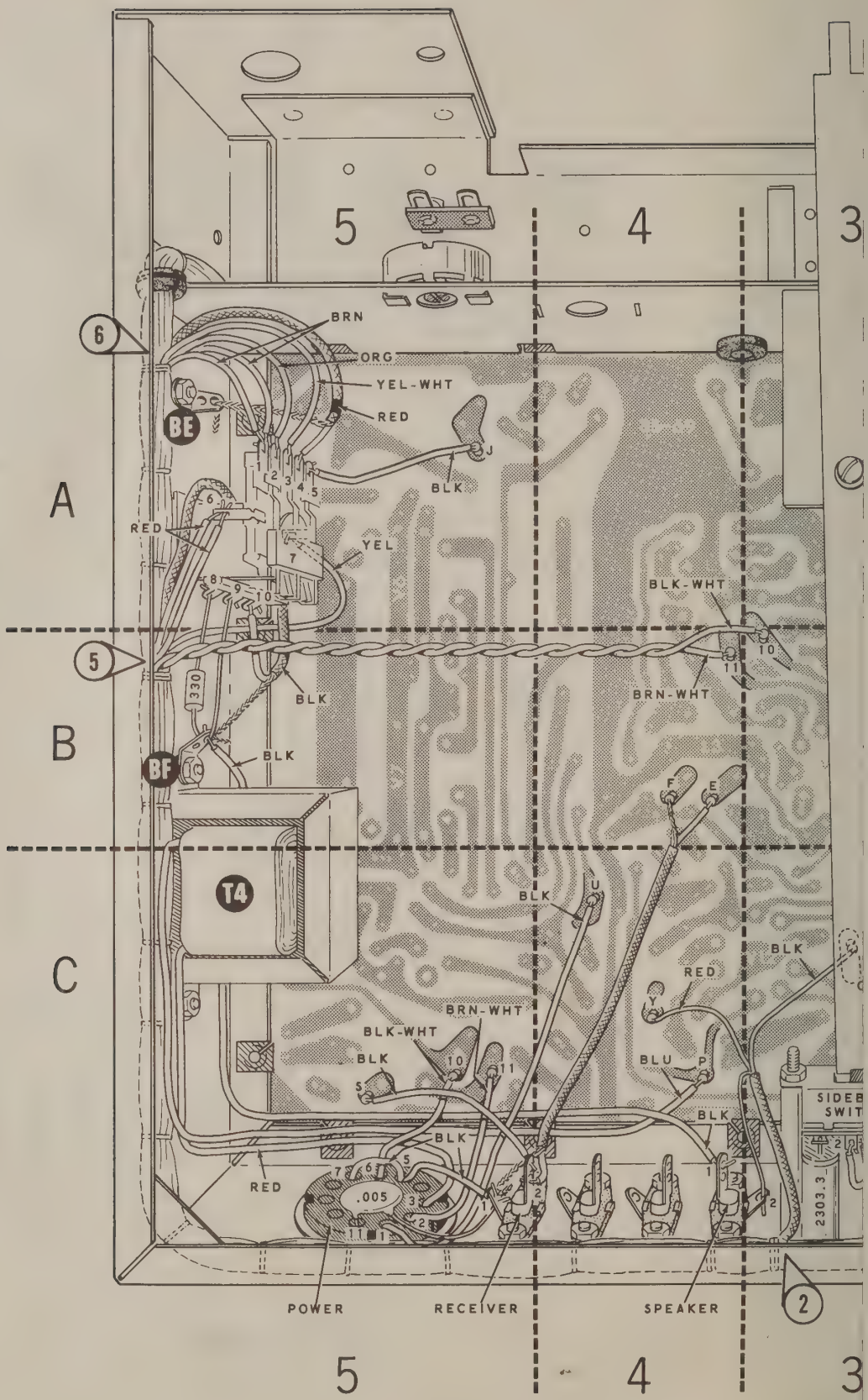
PICTORIAL 2-5



Detail 2-5A

( ) Refer to Detail 2-5A, and position the Function switch into its mounting hole in the chassis. Use a 3/8" control lockwasher. Form the excess harness wires down into the chassis.

The remaining wires from BO#8 will be connected later.


5
4
3
A
B
C
6
5
BRN
ORG
YEL-WHT
RED
BE
BLK
RED
YEL
BLK-WHT
BRN-WHT
330
BLK
BF
BLK
T4
BLK
RED
BRN-WHT
BLK-WHT
BLK
BLU
BLK
BLK
RED
.005
POWER
RECEIVER
SPEAKER
2
SIDEB
SWIT
2303.3
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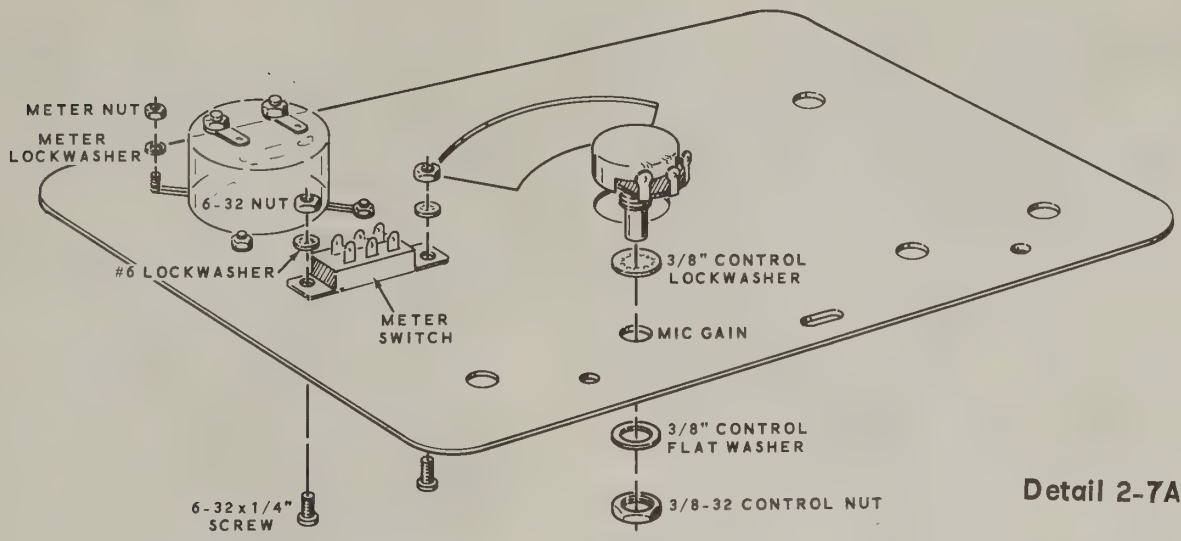
3

PICTORIA



Detail 2-7A

( ) Install a 1 megohm bushing-mount control (#10-17) at the Mic Gain control position. Use a 3/8" control lockwasher, a 3/8" control flat washer, and a 3/8-32 control nut.

Refer to Pictorial 2-7 for the following steps.

( ) Install a 1 megohm/25 KΩ dual tab-mount control (#12-73) at the Receiver Gain (RCVR GAIN) location on the chassis partition. Bend the mounting tabs as shown.

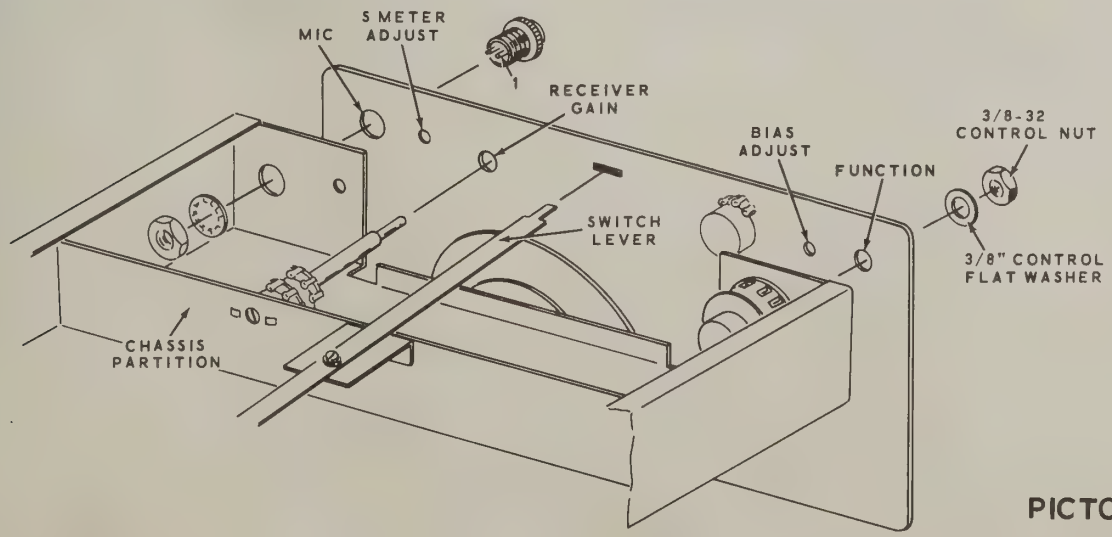
( ) Position the front panel on the chassis. Fit the switch lever through the small slot in the front panel.

( ) Install a 3/8" control flat washer and a 3/8-32 control nut on the Function switch. Do not tighten the nut at this time.

( ) Install the female connector at the Mic location using the lockwasher and nut supplied with the connector. Position lug 1 of the connector as shown. Do not tighten the nut yet.

( ) Carefully line-up the holes of the front panel and chassis at the S Meter Adjust and Bias Adjust locations. Now, tighten the nuts on the Function switch and Mic connector. Be sure the red dot on the Function switch is directly in line with the VOX marking on the front panel.

( ) Operate the switch lever to see that it does not hit either end of the slot in the front panel. If it does, loosen the switch lever mounting bracket and adjust it as required. Retighten the hardware.



PICTORIAL 2-7

FINAL WIRING-CHASSIS BOTTOM

Refer to Pictorial 2-8 for the following steps.

( ) Connect the free end of the red wire extending from grommet BC to lug 2 of terminal strip BA (NS).

Connect the wires from BO#7 as follows:

( ) Green-white to lug 2 of the Mic connector (NS).

( ) Gray-gray-white to lug 1 of the S Meter Adjust control (S-1).

( ) Red-white to lug 2 of the S Meter Adjust control (S-1).

( ) Red to lug 2 of terminal strip BA (NS).

( ) Black coaxial cable: inner lead to lug 1 of the Mic connector (S-1), and the shield to lug 1 of terminal strip BA (NS).

( ) Place a 3/4" length of sleeving on the shield lead of the 2-wire coaxial cable. Then, connect the shield lead to lug 4 (NS), the black lead to lug 5 (NS), and the red lead to lug 6 (S-1) of the Receiver Gain control. Be sure lugs 4, 5, and 6 do not touch the chassis partition.

( ) Violet-violet-white to lug 2 of the Receiver Gain control (S-1).

( ) Connect a 3" black wire from lug 3 of the S Meter Adjust control (NS) to lug 3 of the Receiver Gain control (S-1).

( ) Pass one lead of a .005 μfd disc capacitor through lug 1 of terminal strip BA (S-3) to lug 3 of the S Meter Adjust control (S-2). Place a 3/4" length of sleeving on the other lead and connect it to lug 2 of the Mic connector (S-2).

( ) Place a 7/8" length of sleeving on one lead of a 220 KΩ (red-red-yellow) resistor. Connect this lead to lug 1 of the Receiver Gain control (S-1). Connect the other lead to lug 2 of terminal strip BA (S-3).

( ) Connect a 500 pf disc capacitor between lugs 4 (S-2) and 5 (S-2) of the Receiver Gain control. Be sure the leads of the capacitor and the lugs of the control do not touch the chassis partition.

Connect the wires from BO#8 as follows:

( ) Both brown to lug 1 of terminal strip BB (NS).

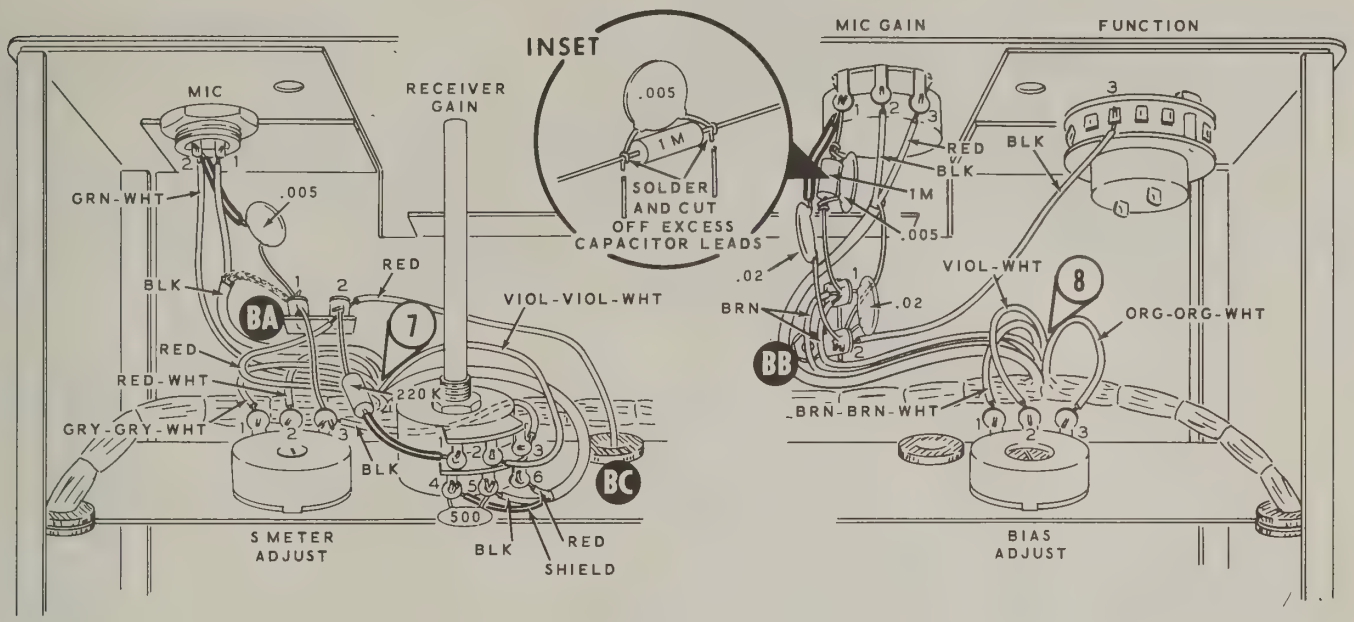
( ) Two-wire coaxial cable: shield lead to lug 2 of terminal strip BB (NS), black lead to lug 2 (S-1), and the red lead to lug 3 (S-1) of the Mic Gain control.

( ) Brown-brown-white to lug 1 of the Bias Adjust control (S-1).

( ) Violet-white to lug 2 of the Bias Adjust control (S-1).

( ) Orange-orange-white to lug 3 of the Bias Adjust control (S-1).

( ) Connect a 4" black wire from lug 2 of terminal strip BB (NS) to lug 3 of the Function switch (S-1).



PICTORIAL 2-8

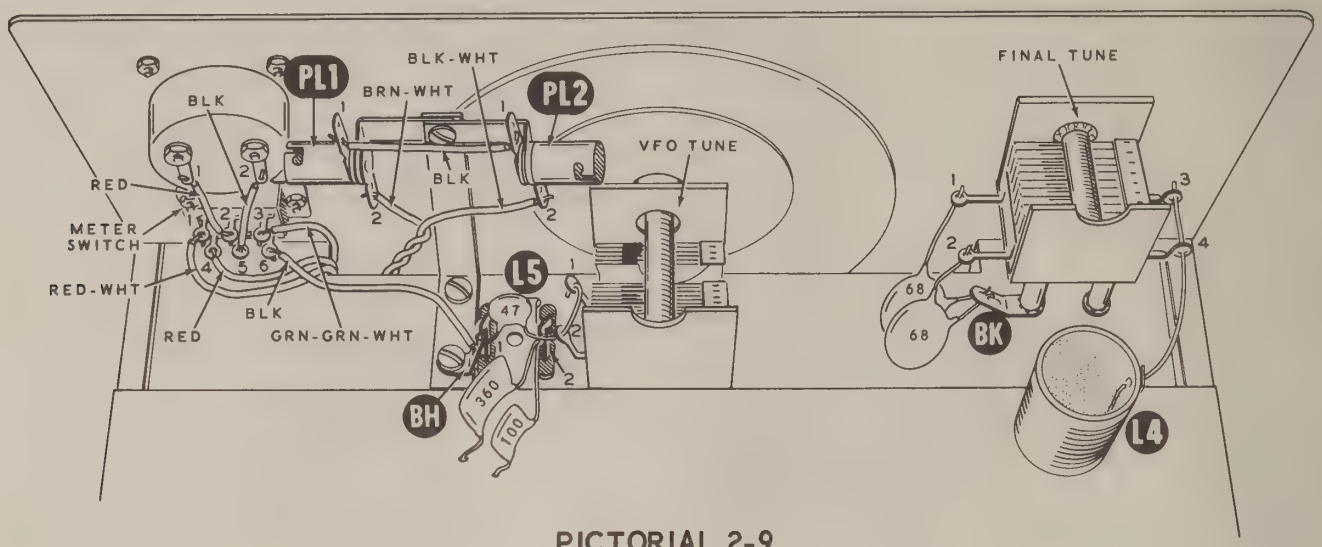
( ) Prepare a resistor capacitor combination using a 1 megohm (brown-black-green) resistor and a .005 µfd disc capacitor as shown in the inset drawing on the Pictorial.

( ) Connect this combination between lug 1 of the Mic Gain control (NS) and lug 1 of terminal strip BB (NS).

( ) Place a 1" length of sleeving on one lead of a .02 µfd disc capacitor. Connect this lead to lug 1 of the Mic Gain control (S-2). Connect the other lead of this capacitor to lug 2 of terminal strip BB (NS).

( ) Connect a .02 µfd disc capacitor between 1 (S-4) and 2 (S-4) of terminal strip BB.

This completes the wiring on the bottom of the chassis. Check to see that all connections are soldered, and shake out any wire clippings or solder splashes. Be sure that all wires are clear of the four small holes in the rear apron of the chassis. This will keep these wires from being damaged when the cabinet is installed later.



PICTORIAL 2-9

FINAL WIRING-CHASSIS TOP

Refer to Pictorial 2-9 for the following steps.

Connect the wires extending from the bottom of the chassis as follows:

( ) Red-white to lug 1 of the Meter switch (S-1).

( ) Green-green-white to lug 3 of the Meter switch (S-1).

( ) Red to lug 4 of the Meter switch (S-1).

( ) Twist together the black-white and brown-white wires to form a twisted pair. Connect the brown-white wire to lug 2 of pilot lamp socket PL1 (S-1), and the black-white wire to lug 2 of pilot lamp socket PL2 (S-1).

( ) Connect a 1-3/4" black wire from lug 1 of pilot lamp socket PL1 (S-1) to lug 1 of pilot lamp socket PL2 (S-1).

( ) Connect a 3" black wire from lug 6 of the Meter switch (S-1) to solder lug BH (NS).

( ) Connect a 1-3/4" red wire from lug 2 of the Meter switch (S-1) to lug 1 of the meter (S-1).

( ) Connect a 2-1/4" black wire from lug 5 of the Meter switch (S-1) to lug 2 of the meter (S-1).

( ) Wrap one lead of a 47 pf disc capacitor around lug 2 of coil L5 (NS), and through lug 2 (S-2), to lug 1 (S-1) of the tuning capacitor. Connect the other lead of the capacitor to lug 1 of coil L5 (S-3). Be sure solder lug BH is soldered to lug 1 of coil L5.

( ) Connect the free leads of the 360 pf mica and 100 pf mica capacitors coming from the circuit board, to lug 2 of coil L5 (S-4).

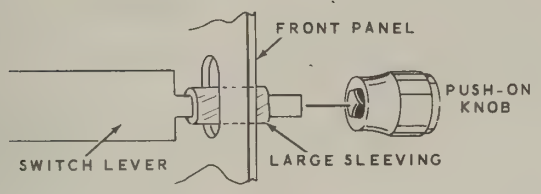
( ) Bend all four lugs of the Final Tune capacitor as shown.

( ) Connect a 68 pf disc capacitor from lug 1 of the Final Tune capacitor (S-1) to solder lug BK (NS).

( ) Connect a 68 pf disc capacitor from lug 2 of the Final Tune capacitor (S-1) to solder lug BK (S-2).

( ) Connect the free lead from coil L4 (on the circuit board) through lug 4 (S-2) to lug 3 (S-1) of the Final Tune capacitor.

This completes the wiring on the top of the chassis. Check to see that all connections are soldered and shake out any wire clippings or solder splashes. There will be a 1000 pf mica capacitor remaining. This capacitor is for use in loading the antenna if needed, as explained later.



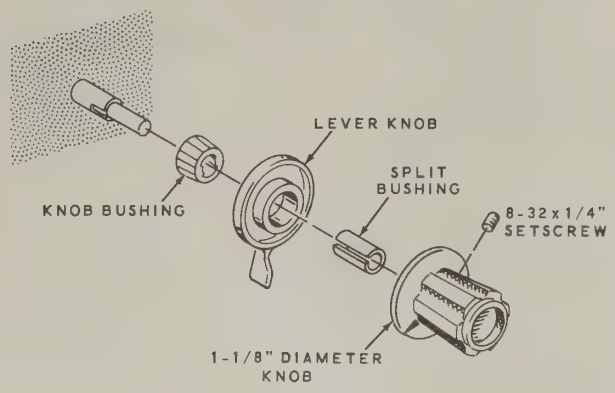
Detail 2-9A

( ) Refer to Detail 2-9A, and install a 1/4" length of large sleeving and the push-on knob on the switch lever at the LSB/USB location of the front panel. Work the sleeving into the slot of the front panel.

( ) Turn all the control, switch, and capacitor shafts fully counterclockwise.

( ) Refer to Detail 2-9B, and install the knob bushing on the large shaft at the Receiver Gain position. Position the knob as shown and push the lever knob on the bushing. Support the rear of this control with your finger when pushing the knob on the knob bushing.

( ) Start 8-32 x 1/4" setscrews in the tapped holes of the 1-1/8" and 2" diameter knobs.



Detail 2-9B

( ) Insert a split bushing in one of the 1-1/8" diameter knobs, and install this knob at the Receiver Gain location. Position the pointer as shown.

( ) Install the 2" diameter knob at the Tuning location.

( ) Install 1-1/8" diameter knobs on the remaining shafts. Position the knob pointer at the Mic Gain location at the 7 o'clock position. The other pointers should be at the fully counterclockwise markings on the panel.

INITIAL TEST

Before installing the tubes and pilot lamps, the following resistance checks should be performed. If the actual resistance readings vary more than ±20% from those listed, refer to the In Case Of Difficulty section of the Manual on Page 53.

Connect the common test lead of an ohmmeter to the chassis and the positive lead to the Test Points listed in the following chart.

NOTE: The internal wiring of most ohmmeters is such that the positive terminal of the ohmmeter battery is connected to the positive (red) test lead, and the negative terminal is connected to the negative (black) test lead. In some ohmmeters, this wiring is reversed and erroneous readings will be obtained when making these measurements. Try reversing the ohmmeter test leads if the measurements do not check out correctly the first time. Also, try different ohmmeter ranges. Diodes conduct in a non-linear manner giving different resistance readings on different ohmmeter ranges.

Refer to Figure 1-1 (fold-out from Page 28) for the locations of the test points. Set the controls as follows:

Sideband switch: LSB.
FUNCTION: PTT.
Meter switch: BIAS SET.
All other controls: Fully counterclockwise.

TEST POINT	RESISTANCE
POWER plug pin 1	33 KΩ
POWER plug pin 2	1000 Ω
POWER plug pin 3	31 KΩ
POWER plug pin 4	Infinity
POWER plug pin 5	0 Ω
POWER plug pin 6	Infinity
POWER plug pin 7	0 Ω
POWER plug pin 8	Infinity
POWER plug pin 9	Infinity
POWER plug pin 10	Infinity
POWER plug pin 11	Infinity
28 in section 1C	9 KΩ
A in section 1C	200 Ω to 500 Ω
B in section 3B	250 KΩ
C in section 1A	3300 Ω
13 in section 1B	220 Ω
Tube socket V4 pin 7	330 Ω
Tube socket V5 pin 1	150 Ω
Tube socket V5 pin 2	200 KΩ to 2.3 megohm
Tube socket V6 pin 3	85 KΩ
Tube socket V9 pin 1	1.25 megohm

TEST POINT	RESISTANCE
Tube socket V12 pin 8	35 KΩ
Tube socket V12 pin 6	120 Ω
Tube socket V1 pin 9	1 to 2 megohm (varies with setting of MIC GAIN control)
Tube socket V10 pin 1	0 Ω
Tube socket V2 pin 9	23 megohm
6 in section 4C	0 to 500 KΩ (varies with setting of VOX SENS control)
9 in section 2C	0 Ω
MIC #1	Infinity
MIC #2	23 megohm
16 in section 5C	0 Ω
Set FUNCTION switch to VOX	
Tube socket V10 pin 1	2 megohm
Tube socket V2 pin 9	23 megohm
9 in section 2C	0 Ω
MIC #2	23 megohm
Set FUNCTION switch to CAL	
16 in section 5C	131 KΩ
MIC#2	23 megohm

TEST POINT	RESISTANCE
( ) Set FUNCTION switch to TUNE	
( ) Tube socket V10 pin 1	2 megohm
( ) Tube socket V2 pin 9	0 Ω
( ) 9 in section 2C	0 to 20 KΩ (varies with setting of TUNE LEVEL control)
( ) MIC#2	0 Ω
( ) Set FUNCTION switch to PTT and the Meter switch to OPERATE TUNE	

NOTE: Use the OHMS X100 range. Just touch the test point and note that the S Meter deflects; do not attempt to measure the resistance.

( ) 13 in section 1B	S Meter deflects a small amount (direction depends on ohmmeter polarity)
( ) Set FUNCTION switch to TUNE and use OHMS X100 range	
( ) 24 in section 4A	S Meter deflects
( ) Set FUNCTION switch to PTT and the Meter switch to BIAS SET. Use OHMS X1 range.	
( ) 25 in section 5C.	Meter deflects (opposite direction)
( ) SPKR socket	0.4 Ω
( ) POWER plug pin 11	Infinity, then press relay for 0 Ω

TEST POINT	RESISTANCE
( ) ANT socket	0.4 Ω, then press relay for 10 KΩ
( ) RCVR socket	0.1 Ω

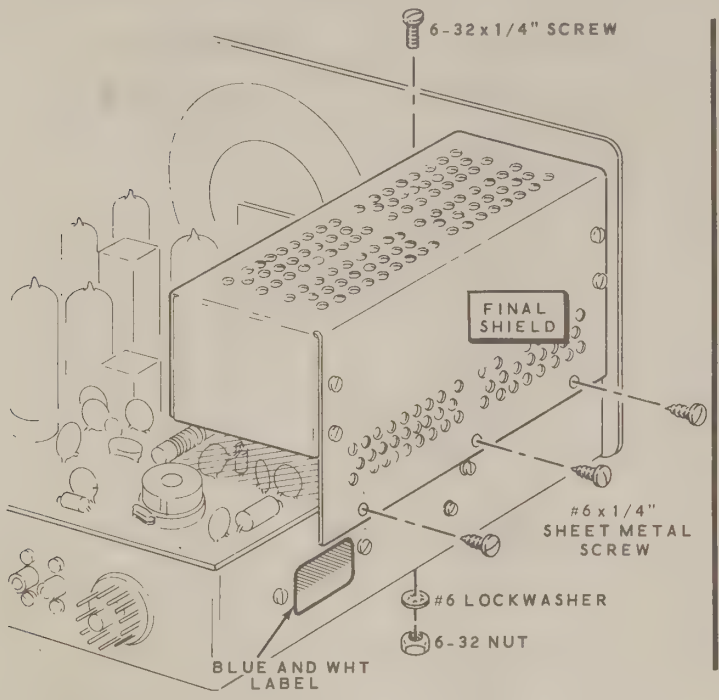
NOTE: Use the proper ohmmeter ranges for each of the following tests.

( ) 1 in section 1C	15 KΩ, then press relay for 330 Ω
( ) 3 in section 4B	330 Ω, then press relay for 120 KΩ
( ) 27 in section 3C	0 to 22 KΩ (varies with setting of RF ATTN control)
( ) G in section 3C	0 to 1 megohm (varies with setting of AF VOL control)
( ) Tube socket V6 pin 3	80 KΩ, press relay for 70 KΩ
( ) ALC socket	2.2 megohm (may be 30 KΩ with ohmmeter leads reversed)

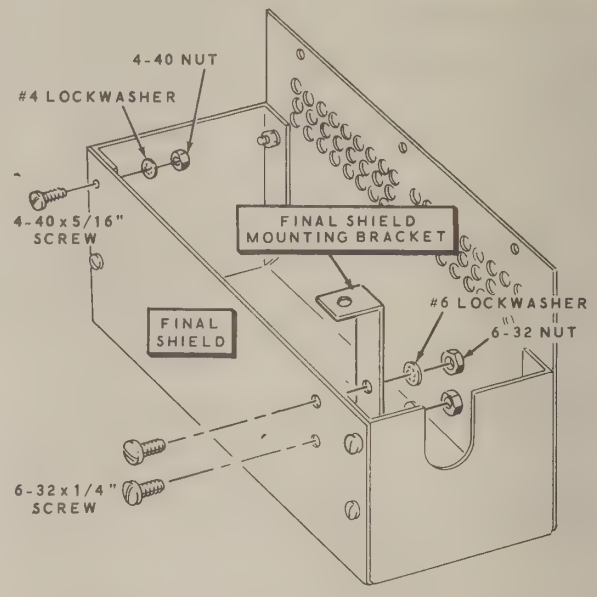
This completes the Initial Tests.

( ) Install the tubes in their respective sockets. The tube numbers are lettered on the circuit board. Support the circuit board from underneath with your finger while installing tubes to prevent damage to the circuit board.

( ) Install the pilot lamps in their sockets. Be sure the one lamp does not touch the case of the meter.



PICTORIAL 2-10



Detail 2-10A

Refer to Pictorial 2-10 and Detail 2-10A for the following steps.

( ) Install 4-40 hardware in the eight end holes of the final shield.

( ) Mount the final shield mounting bracket on the final shield with 6-32 x 1/4" hardware.

( ) Mount the final shield on the chassis with three #6 x 1/4" sheet metal screws in the side of the chassis, and 6-32 x 1/4" hardware in the top of the chassis. Fit the front of the shield between the front panel and the Final Tune capacitor.

( ) Carefully peel away the backing paper from the blue and white identification label. Then press the label onto the side of the chassis. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.

POWER SUPPLY CONNECTIONS

This Transceiver was designed to operate with the Heathkit Models HP-13 (12 VDC power source) and HP-23 (120 VAC power source) Power Supplies. The following information will help you wire the 11-pin socket (supplied with the Transceiver) for the power cable of the Power Supply you intend to use.

HP-13 POWER SUPPLY CONNECTIONS

CAUTION: Be sure the alternate connection in the low voltage DC circuit of the HP-13 Power Supply is connected for +250 volts output as outlined in the HP-13 Manual. Be sure the charging limit of the automobile voltage regulator is set to not exceed 14.5 volts.

Refer to Figure 2-1 for the following steps.

( ) Install the 11-pin socket cap over the free end of the 8-wire cable from the HP-13 Power Supply, as shown.

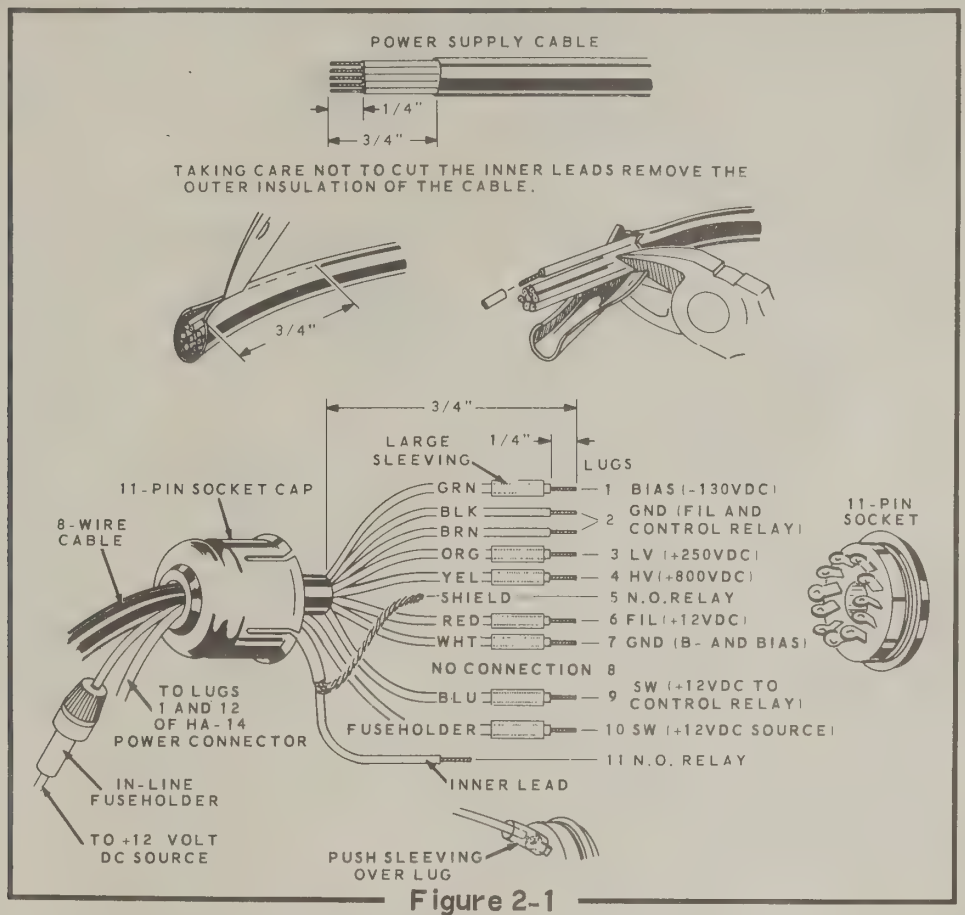

POWER SUPPLY CABLE
1/4"
3/4"
TAKING CARE NOT TO CUT THE INNER LEADS REMOVE THE OUTER INSULATION OF THE CABLE.
3/4"
3/4"
1/4"
LARGE SLEEVING
LUGS
11-PIN SOCKET CAP
8-WIRE CABLE
GRN — 1 BIAS (-130VDC)
BLK — 2 GND (FIL AND CONTROL RELAY)
BRN
ORG — 3 LV (+250VDC)
YEL — 4 HV (+800VDC)
SHIELD — 5 N.O. RELAY
RED — 6 FIL (+12VDC)
WHT — 7 GND (B- AND BIAS)
NO CONNECTION 8
BLU — 9 SW (+12VDC TO CONTROL RELAY)
FUSEHOLDER — 10 SW (+12VDC SOURCE)
11 N.O. RELAY
11-PIN SOCKET
TO LUGS 1 AND 12 OF HA-14 POWER CONNECTOR
IN-LINE FUSEHOLDER
TO +12 VOLT DC SOURCE
INNER LEAD
PUSH SLEEVING OVER LUG

Figure 2-1

(√) Remove 3/4" of the outer insulation from the end of the 8-wire cable. Then remove 1/4" of insulation from the end of each wire.

(√) Melt a small amount of solder on each of the exposed wire ends to hold the small strands of wire together.

(√) Insert the lead from the cap end of the fuseholder (an in-line fuseholder with lead is supplied with the HP-13 Power Supply) through the socket cap as shown.

If the Heathkit HA-14 Linear Amplifier is used, a coaxial cable, that has its inner lead connected to lug 12 and its shield connected to lug 1 of the HA-14 power connector, should be inserted through the socket cap as shown.

(√) Cut seven 5/8" lengths of large sleeving and slip them over the indicated wires.

( ) Connect the wires of the 8-wire cable, the fuseholder lead, and the coaxial cable (if the HA-14 Linear Amplifier is used) to the 11-pin socket lugs as shown. Solder each connection.

( ) Push the lengths of sleeving over the lugs of the socket.

( ) Snap the socket cap onto the 11-pin socket. IMPORTANT: When using the HP-13 Power Supply with the Transceiver, be sure the Bias control of the Power Supply is in its fully clockwise position. This setting will supply full bias voltage to pin 9 of the power socket.

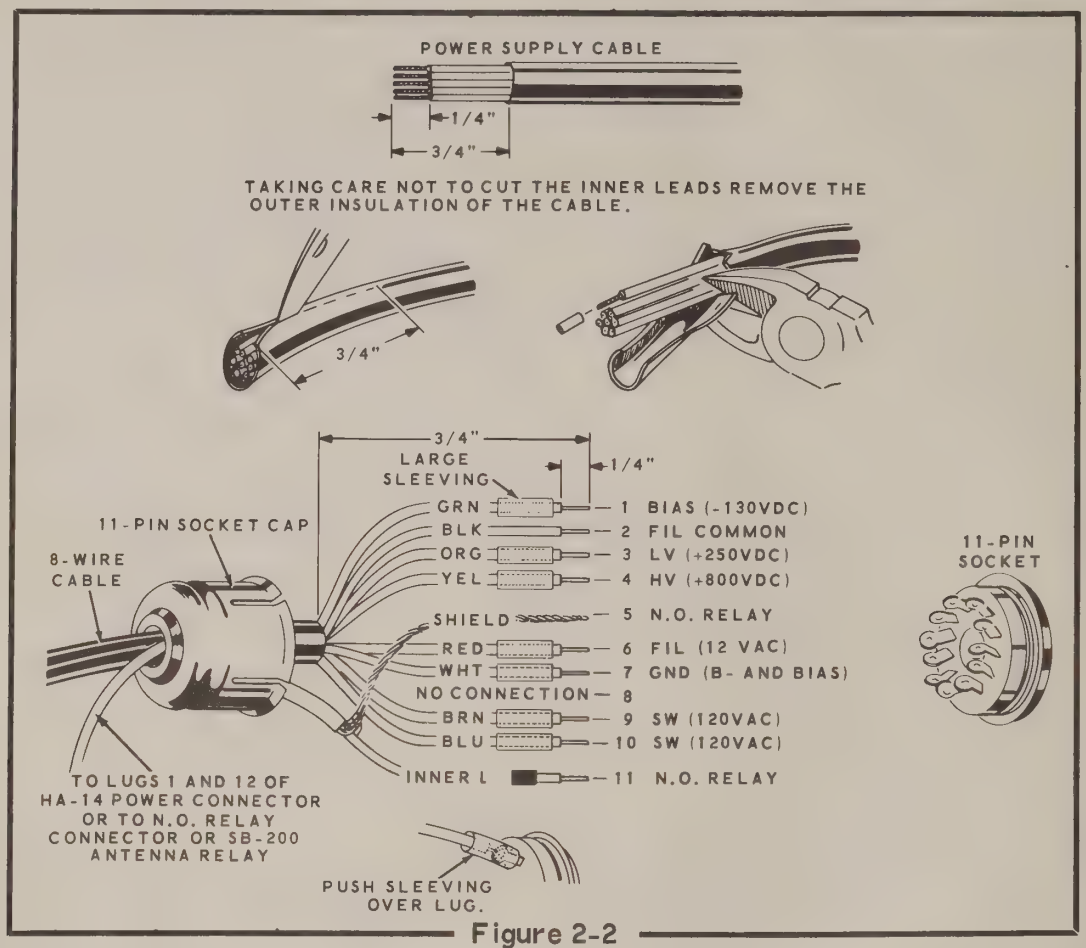

POWER SUPPLY CABLE
1/4"
3/4"
TAKING CARE NOT TO CUT THE INNER LEADS REMOVE THE OUTER INSULATION OF THE CABLE.
3/4"
3/4"
LARGE SLEEVING
1/4"
11-PIN SOCKET CAP
8-WIRE CABLE
GRN — 1 BIAS (-130VDC)
BLK — 2 FIL COMMON
ORG — 3 LV (+250VDC)
YEL — 4 HV (+800VDC)
SHIELD — 5 N.O. RELAY
RED — 6 FIL (12 VAC)
WHT — 7 GND (B- AND BIAS)
NO CONNECTION — 8
BRN — 9 SW (120VAC)
BLU — 10 SW (120VAC)
INNER L — 11 N.O. RELAY
11-PIN SOCKET
TO LUGS 1 AND 12 OF HA-14 POWER CONNECTOR OR TO N.O. RELAY CONNECTOR OR SB-200 ANTENNA RELAY
PUSH SLEEVING OVER LUG.

Figure 2-2

HP-23 POWER SUPPLY CONNECTIONS

CAUTION: Be sure the alternate connection in the low voltage DC circuit of the HP-23 Power Supply is connected to +250 volts DC output as outlined in the HP-23 Manual.

Refer to Figure 2-2 for the following steps.

( ) Install the 11-pin socket cap over the free end of the 8-wire cable from the Power Supply.

( ) Remove 3/4" of the outer insulation from the end of the 8-wire cable. Then remove 1/4" of insulation from the end of each wire.

( ) Melt a small amount of solder on each of the exposed wire ends to hold the small strands of wire together.

If the Heathkit Model HA-14 Linear Amplifier is to be used, a coaxial cable from the HA-14 power connector should be inserted through the socket cap as shown. Use the coaxial cable with the inner lead connected to lug 12 and the shield to lug 1 of the HA-14 power connector. For the SB-200 and other Linear Amplifiers, use a piece of coaxial cable through the cap to bring out the relay connections.

( ) Cut seven 5/8" lengths of large sleeving and slip them over the indicated wires.

( ) Connect the wires of the 8-wire cable and the coaxial cable (if a Linear Amplifier is used) to the 11-pin socket lugs as shown. Solder each connection.

( ) Push the lengths of sleeving over the lugs of the socket.

( ) Snap the socket cap onto the 11-pin socket.

NOTE: With the above connections, the Bias control in the HP-23 Power Supply is inoperative. Proper bias settings are accomplished with the Bias control in the Transceiver.

ALIGNMENT AND ADJUSTMENT

Refer to Figure 1-1 (fold-out from Page 28) for the following steps.

Set the controls as follows:

RF ATTN: fully clockwise.
VOX SENS, VOX DELAY, AF VOL, and TUNE LEVEL: half rotation.
BIAS ADJ and MIC GAIN: fully counterclockwise.
Meter switch: BIAS SET.
FUNCTION switch: OFF.
Sideband switch: LSB.
S METER ADJ: fully counterclockwise.
CARRIER NULL: any position.

Using an ohmmeter, make the following resistance checks at the Power plug:

TEST POINT	RESISTANCE
Pin 1	37 KΩ
Pin 3	33 KΩ
Pin 4	Infinity

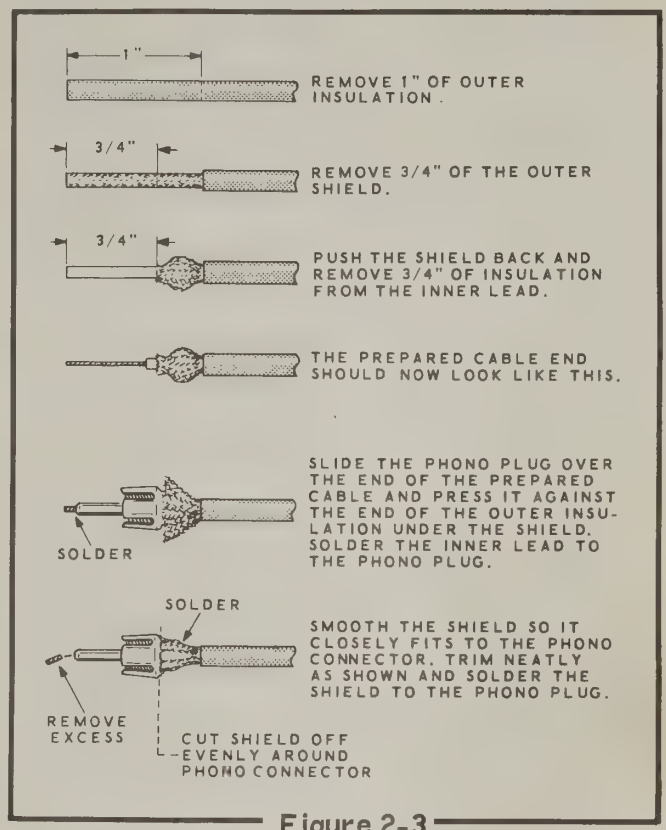
If any of these resistance readings vary more than ±20%, refer to the In Case Of Difficulty section of the Manual before proceeding.

RECEIVER ALIGNMENT

NOTE: Phono plugs are provided for making connections to the sockets on the rear of the Transceiver. Refer to Figure 2-3 for wiring a phono plug to a coaxial cable.

Connect an 8 Ω speaker (a 3.2 Ω to 16 Ω speaker may be used with reduced efficiency) to the SPKR socket, and a 50 Ω dummy load to the ANT socket. With the power supply wired according to the instructions in the Power Supply section of the Manual, connect it to the Transceiver Power plug. Make sure the VOX DELAY control is at the center of its rotation. The relay will click during the first few seconds of warmup. This is normal.

( ) Turn the FUNCTION switch to PTT. The pilot lamps and the tube filaments should light. Watch to see that the meter remains at zero; if it should start to deflect, the Transceiver should be turned off immediately, as the bias circuit of tube stages V6 and V7 is probably shorted and must be corrected before proceeding.


1"
REMOVE 1" OF OUTER INSULATION.
3/4"
REMOVE 3/4" OF THE OUTER SHIELD.
3/4"
PUSH THE SHIELD BACK AND REMOVE 3/4" OF INSULATION FROM THE INNER LEAD.
THE PREPARED CABLE END SHOULD NOW LOOK LIKE THIS.
SLIDE THE PHONO PLUG OVER THE END OF THE PREPARED CABLE AND PRESS IT AGAINST THE END OF THE OUTER INSULATION UNDER THE SHIELD. SOLDER THE INNER LEAD TO THE PHONO PLUG.
SOLDER
SOLDER
SMOOTH THE SHIELD SO IT CLOSELY FITS TO THE PHONO CONNECTOR. TRIM NEATLY AS SHOWN AND SOLDER THE SHIELD TO THE PHONO PLUG.
REMOVE EXCESS
CUT SHIELD OFF EVENLY AROUND PHONO CONNECTOR
Figure 2-3

( ) Place the Meter switch in the OPERATE TUNE position and adjust the S METER ADJ control for a zero indication on the meter.

( ) Remove the dummy load from the ANT socket and plug an antenna into the ANT socket.

( ) Turn up the AF VOL control until noise is heard in the speaker. Tune up and down the band with the VFO. Stations should be heard if there is any local activity.

( ) Tune in a station that gives approximately a midscale (S9) meter reading.

( ) Adjust the top and bottom slugs of receiver IF transformer T3 for the highest meter reading. Use the short end of the alignment tool for the top slug, and the long end of the alignment tool for the bottom slug. When passing the long end of the alignment tool through the top slug to reach the bottom slug, be careful not to disturb the adjustment of the top slug.

( ) Repeat the adjustment of T3 for the highest meter reading.

( ) Turn the FUNCTION switch to OFF.

( ) Turn the VFO dial fully counterclockwise until the plates of the VFO capacitor are fully closed.

( ) Loosen the setscrew of the dial. Rotate the dial so that the end of the white strip near the 3.8 marking is aligned with the hairline and tighten the setscrew. Check to see that full rotation of the dial does not cause any drag or rubbing. If it does, move the dial or knob slightly on the shaft, then recalibrate and retighten the setscrew with the spring washer compressed about half way.

( ) Bend the pilot lamp bracket and adjust the lamp positions for best illumination of the dial and meter.

VFO CALIBRATION

Disconnect the antenna from the Transceiver and plug the dummy load into the ANT socket.

The following steps present two ways to check the dial calibration with two different types of receivers. Use the method that applies to the type of receiver available.

Calibration With A Standard AM Broadcast Receiver

( ) Connect one end of a short wire to the antenna terminal of the broadcast receiver. Place the other end of this wire near tube V14 in the Transceiver.

( ) Tune the receiver dial to a station of known frequency between 1495 kHz and 1695 kHz. Now, add 2305 kHz to this dial frequency and set the VFO dial to the sum of these two frequencies.

Example:

Receiver frequency:	1540 kHz
Add:	2305 kHz
Set VFO dial to:	3845 kHz

( ) With the Sideband switch in LSB, set the FUNCTION switch to PTT and allow the Transceiver to warm up.

( ) Adjust the slug of coil L5 until the VFO is heard in the speaker of the receiver. Coil L5 will normally have to be turned counterclockwise, as viewed from the top of the chassis. The VFO trimmer need not be adjusted at this time.

( ) Turn the FUNCTION switch to OFF.

This alignment should calibrate the VFO fairly closely. However, do not operate the Transceiver near the ends of the VFO dial until the VFO calibration is checked with a crystal calibrator or a very accurate amateur receiver.

Calibration With Amateur Band Receiver

NOTE: The following procedure gives the correct dial readings for zero beat (carrier frequency) in LSB only. In USB, the dial reading is 3.4 kHz higher than the carrier frequency.

( ) Connect one end of a short wire to the antenna terminal of the receiver. Place the other end of this wire near tube V4 in the Transceiver.

( ) Temporarily remove V5, the 12BY7 tube.

( ) With the Sideband switch in the LSB position, turn the FUNCTION switch to TUNE and allow the Transceiver to warm up.

( ) Move the Meter switch to BIAS SET. The meter should indicate "0." If it is not at "0," check to see that the BIAS ADJUST control is in its fully counterclockwise position. If the meter still will not reach "0," turn the Transceiver OFF and check the bias circuitry before proceeding.

( ) Set the dials of the receiver and Transceiver to 3.9 megahertz. The receiver should be operated in the CW mode.

NOTE: The VFO trimmer can be adjusted in the following step by inserting an insulated screwdriver through the large hole in the side of the final shield.

( ) Adjust coil L5 clockwise (from the top of the chassis) until the Transceiver signal is heard in the amateur receiver speaker. Check the VFO dial calibration by setting the dials of both the receiver and Transceiver first to 3.8 megahertz and then to 4.0 megahertz. The calibration should check near these points, and any dial variations should be corrected by adjusting coil L5 at 3.8 megahertz and the trimmer on the VFO variable capacitor at 4.0 megahertz.

( ) Turn the FUNCTION switch to OFF.

( ) Replace tube V5.

Crystal Calibrator Check Of VFO Dial Settings

The preceding adjustments of the VFO will only be as accurate as the receiver used. The calibration can be accurately checked by using the Heathkit plug-in Crystal Calibrator as an accessory with the Transceiver. The Crystal Calibrator accuracy should be checked against WWV by using a receiver other than the one in the Transceiver to set the Calibrator at 5, 10, or 15 megahertz. Other 100 kHz calibrators can be used by connecting their output to the antenna socket.

NOTE: The following procedure gives the correct dial readings for zero beat (carrier frequenc) in LSB only. In USB, the dial reading is displaced and reads 3.4 kHz higher than the carrier frequency.

( ) Plug the Crystal Calibrator into the calibrator socket of the Transceiver.

( ) With the antenna plugged into the ANT socket, place the FUNCTION switch in the CAL position, the Sideband switch in the LSB position, and the Meter switch in the OPERATE TUNE position. Allow sufficient time for the Calibrator to warm up.

( ) Check the calibration accuracy of the VFO at the 3.8, 3.9, and 4.0 megahertz settings of the VFO dial of the Transceiver. Any dial variations should be corrected by adjusting coil L5 at 3.8 megahertz and the VFO trimmer at 4.0 megahertz. Repeat until the dial checks with the calibrator signals.

( ) Turn the FUNCTION switch to OFF.

TRANSMITTER ALIGNMENT

Bias Setting

(✓) Connect the dummy load to the ANT socket.

(✓) Remove V5, the 12BY7 tube.

(✓) Set the FUNCTION switch to TUNE and the Meter switch to BIAS SET.

(✓) Then adjust the BIAS ADJ control for a reading of S3 on the meter. There is a small triangle above the "3" on the meter to indicate the proper bias setting.

(✓) Turn the FUNCTION switch to OFF, and replace tube V5.

IF Amplifier Adjustment

(✓) With the VFO dial set to 3.8, turn the FUNCTION switch to the TUNE position and the Meter switch to TUNE OPERATE. The meter should indicate some output.

(✓) Adjust the FINAL TUNE control for maximum output, which should give a reading of over S3 on the Transceiver meter. If the meter goes above S9, adjust the CARRIER NULL control to drop the level to S9. If the output level is too low, adjust the CARRIER NULL and/or TUNE LEVEL to obtain an S3 reading.

(✓) Adjust both slugs of transformer T2 for a maximum meter indication.

Balanced Modulator Adjustment

( ) Connect a voltmeter across the dummy load (if your dummy load provides a DC voltmeter connection), or to connector 24 (section 4A on the circuit board), or use a VTVM with an RF probe positioned near the dummy load. Do not connect the RF probe to the dummy load as there is sufficient voltage output to burn out the diodes of some RF probes.

NOTE: If a voltmeter is not available, the panel meter may be used, with reduced accuracy. Set the FUNCTION switch to TUNE and the TUNE LEVEL control to its fully counterclockwise position. Another receiver can also be used as a null indicator.

( ) Place the FUNCTION switch in the PTT position. Allow the Transceiver to warmup for at least one-half hour before adjusting the balanced modulator.

( ) With the Sideband switch in the LSB position, press the PTT switch or ground lug 2 of the MIC socket with a short wire, and adjust the CARRIER NULL control for a minimum signal indication on the meter.

( ) Using the long end of the alignment tool, turn the bottom slug of transformer T1 two full turns toward the bottom of its travel (clockwise from the top of the chassis).

( ) Adjust the top slug of T1 for a maximum signal indication. This should take only a very slight turn of the slug. If the slug is turned down too far, a larger, but false peak will appear.

( ) Again, adjust the CARRIER NULL control for a minimum signal indication.

NOTE: The signal level should now become quite low, and if a VTVM and RF probe are being used, the probe should be connected to the center pin (pin 2) of the ANT socket.

( ) Now adjust the bottom slug of T1 back up into the transformer. As the slug is adjusted, there will be a dip to a minimum indication. Adjust the slug for this minimum (dip) indication.

( ) Readjust the CARRIER NULL control and the bottom slug of transformer T1 for the lowest possible minimum signal indication. The adjustments are now quite critical; turn them slowly. Repeat this adjustment until the best null is obtained.

( ) Change the Sideband switch to USB and check the null. Repeat the adjustment in the previous step for both the LSB and USB positions, until the best null setting is obtained. Measured RF voltage should be 0.5 volts or less at null.

( ) Disconnect the voltmeter (or VTVM) from the Transceiver and if used, the wire connected between lug 2 of the MIC socket and the chassis.

( ) Turn the FUNCTION switch to TUNE and the Meter switch to OPERATE TUNE.

( ) Adjust the TUNE LEVEL control to obtain a meter reading between S3 and S6. This reading will normally vary as you tune across the band, and between LSB and USB.

Driver Tuning

The driver tuning coils, L2 and L3, are preset at the factory and need no further adjustment.

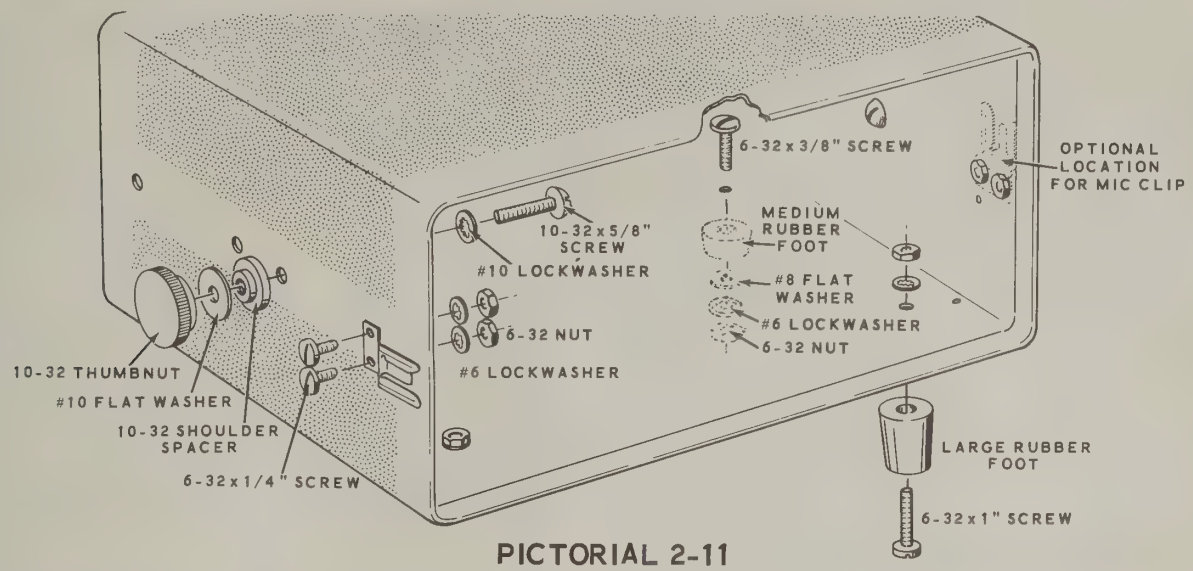
FINAL ASSEMBLY

FIXED STATION-MOBILE CONSIDERATIONS

Before installing the Transceiver in the cabinet, determine whether it will be used for fixed station or mobile operation, or both. For fixed station use only, perform the steps under "For Fixed Stations;" for mobile use only, perform the steps under "For Mobile Stations." If you plan to use the Transceiver alternately in fixed station and mobile installations, perform the steps in both sections.

Refer to Pictorial 2-11 for the following steps.

NOTE: If a microphone clip is to be used (supplied with your microphone), it may be installed on either end of the cabinet, so the microphone can be lifted up and out, or so the microphone can be pulled toward the front and out. Use 6-32 x 1/4" hardware to mount the microphone clip.



PICTORIAL 2-11

For Fixed Stations

( ) Install the medium rubber feet at the rear holes in the bottom of the cabinet, using 6-32 x 3/8" hardware and #8 flat washers.

( ) Install large rubber feet at the front holes (nearest the perforated area) in the bottom of the cabinet, using 6-32 x 1" hardware.

For Mobile Stations

Determine whether the Transceiver is to be mounted under the dash or on the floor of the automobile. See Figure 3-1. If under-the-dash mounting is preferred, there are two holes near the center on each side of the cabinet which can be used for mounting. For floor mounting, the holes at the rear on each side of the cabinet can be used. Choose the holes that will provide best balance for your installation.

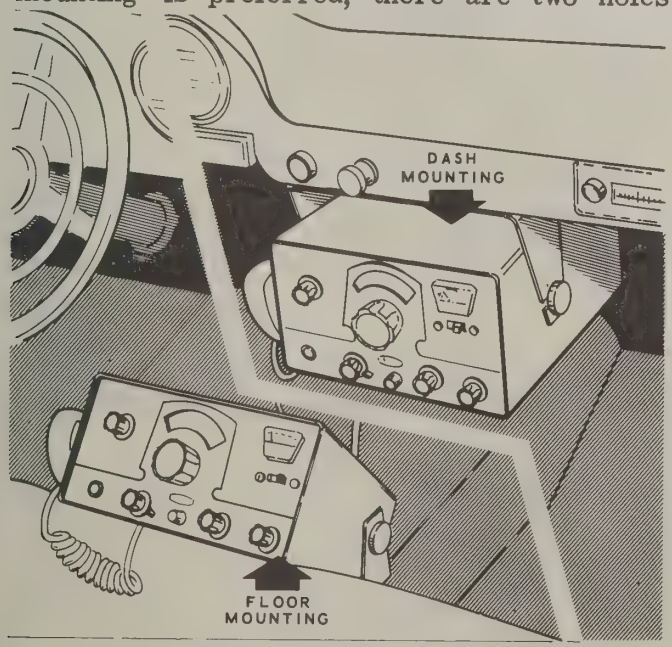
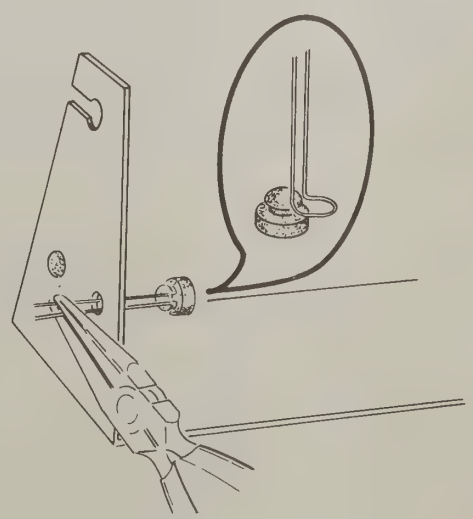


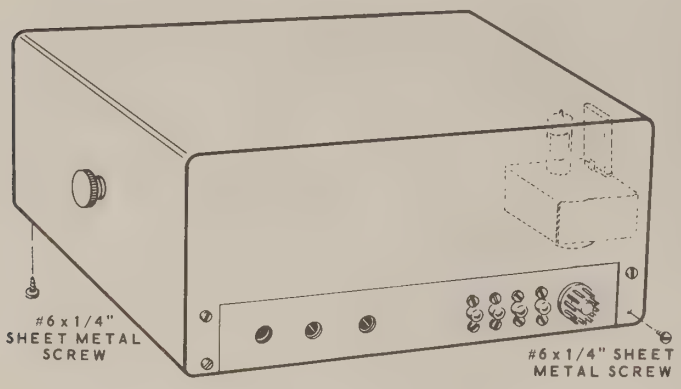
Figure 3-1

( ) Mount the gimbal bracket hardware in the cabinet holes decided upon. Use 10-32 x 5/8" screws, #10 lockwashers, 10-32 shoulder spacers, #10 flat washers, and 10-32 thumbnuts. See Pictorial 2-11.

( ) Refer to Detail 2-11A, and install four small rubber feet into the gimbal bracket. This is easily done by looping a length of bare wire around the groove of the rubber foot and passing the wire through the hole in the gimbal bracket. Pull on the wire until the rubber foot is properly seated in the hole.



Detail 2-11A



PICTORIAL 2-12

CRYSTAL CALIBRATOR MOUNTING

Refer to Pictorial 2-12 for the following steps.

If the Heathkit plug-in Crystal Calibrator is to be used with the Transceiver, plug it into the Calibrator socket of the Transceiver.

CABINET MOUNTING

Refer to Pictorial 2-12 for the following steps.

( ) Slide the Transceiver chassis into the cabinet. If the Crystal Calibrator is used, be careful not to damage it when sliding the Transceiver into the cabinet.

( ) Secure the chassis in the cabinet with six #6 x 1/4" sheet metal screws, four in the back and two in the bottom. Be sure the screws do not hit any of the wires under the chassis.

MICROPHONE

Any high impedance crystal, dynamic, or ceramic microphone with an output rating between -45 db and -60 db can be used with the Transceiver.

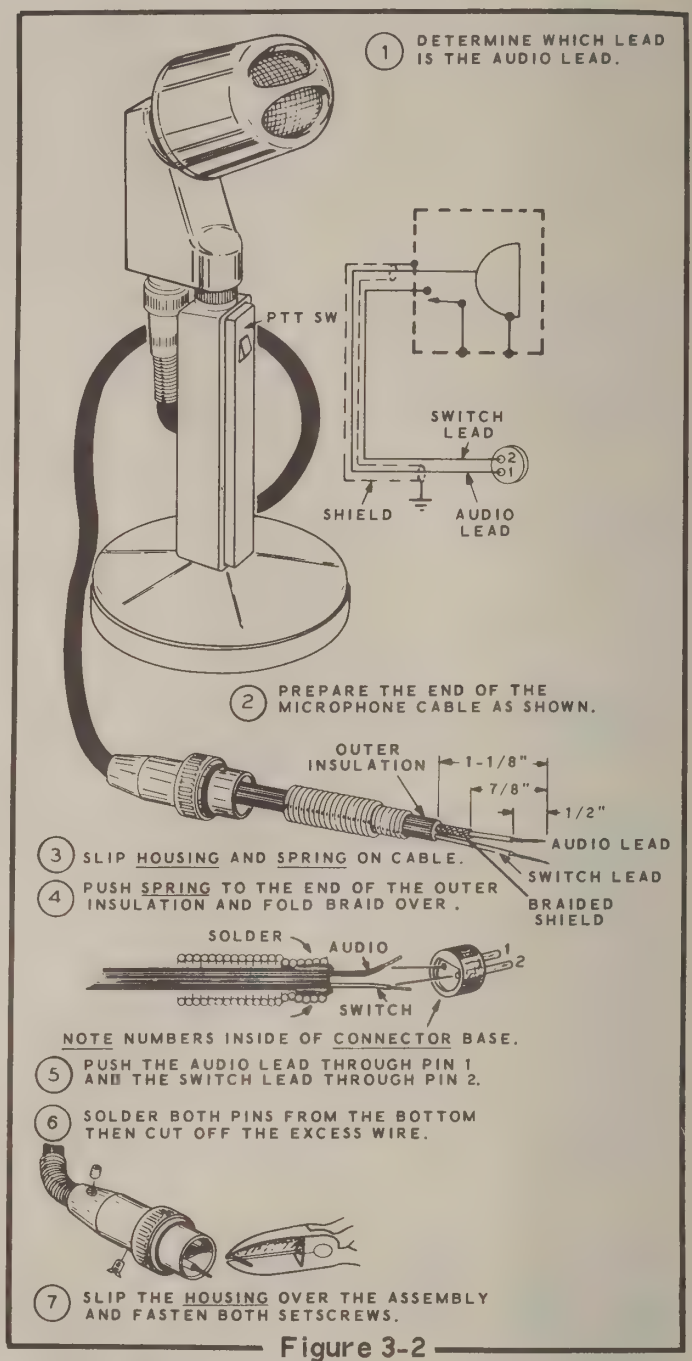

1 DETERMINE WHICH LEAD IS THE AUDIO LEAD.
PTT SW
SWITCH LEAD
SHIELD
AUDIO LEAD
2 PREPARE THE END OF THE MICROPHONE CABLE AS SHOWN.
OUTER INSULATION
1-1/8"
7/8"
1/2"
AUDIO LEAD
SWITCH LEAD
BRAIDED SHIELD
3 SLIP HOUSING AND SPRING ON CABLE.
4 PUSH SPRING TO THE END OF THE OUTER INSULATION AND FOLD BRAID OVER.
SOLDER
AUDIO
SWITCH
NOTE NUMBERS INSIDE OF CONNECTOR BASE.
5 PUSH THE AUDIO LEAD THROUGH PIN 1 AND THE SWITCH LEAD THROUGH PIN 2.
6 SOLDER BOTH PINS FROM THE BOTTOM THEN CUT OFF THE EXCESS WIRE.
7 SLIP THE HOUSING OVER THE ASSEMBLY AND FASTEN BOTH SETSCREWS.

Figure 3-2

Figure 3-2 shows how most communication microphones can be wired for VOX, PTT, or both types of operation. The only difference in wiring to change the microphone from just PTT operation to both types of operation, is the addition of the jumper wire in the microphone. This additional wire keeps the audio lead from being opened when the microphone button is released, thus permitting VOX operation with the Transceiver. When wired in this manner the switch of the microphone will actuate the relay of the Transceiver for PTT operation.

A microphone without a switch can be used for VOX operation if you install the male microphone connector supplied with this Transceiver. The audio lead should be connected to pin #1 and the shield should be connected to the spring of the connector.

INSTALLATION

FIXED STATION

The Transceiver must be placed in a location with adequate ventilation because of the amount of heat given off by the tubes. Inadequate ventilation could cause considerable damage to the circuit components.

The power supply can be mounted in the SB-600 Speaker cabinet (if used) or in some other out-of-the-way place, since it is controlled by the FUNCTION switch of the Transceiver.

Because the Transceiver requires about 300 watts of power when transmitting, it should not be operated from an already heavily loaded AC outlet.

The Transceiver should be grounded to a ground rod or cold water pipe. Make the ground connection to the Transceiver at one of the sideband switch mounting screws.

A doublet antenna fed by RG-58 or RG-59 cable, or an inverted "Vee" type antenna fed with coaxial cable will work very well with the Transceiver. Other types of antennas using high impedance end-feeding, off-center feeding, open wire lines, or 300 Ω twin lead, can be used if an antenna coupler is used between the antenna and Transceiver. The antenna used must provide a low SWR (standing wave ratio) to the Transceiver for successful operation. Lightning arrestors on the antenna are a must. The antenna should be disconnected and grounded, and the Transceiver should be taken off the air when a lightning storm is near.

The FINAL TUNE knob should peak near the center third of rotation with a properly matched antenna. Connect an SWR bridge to the antenna and make sure the SWR is below 1.5 to 1. Power for operating the bridge may be obtained by carrier output in the TUNE position of the FUNCTION switch.

Use an 8 Ω speaker capable of handling one watt of audio power.

Two typical installations are shown in Figures 4-1 and 4-2. Figure 4-1 shows a basic hookup suitable for either fixed station or mobile operation.

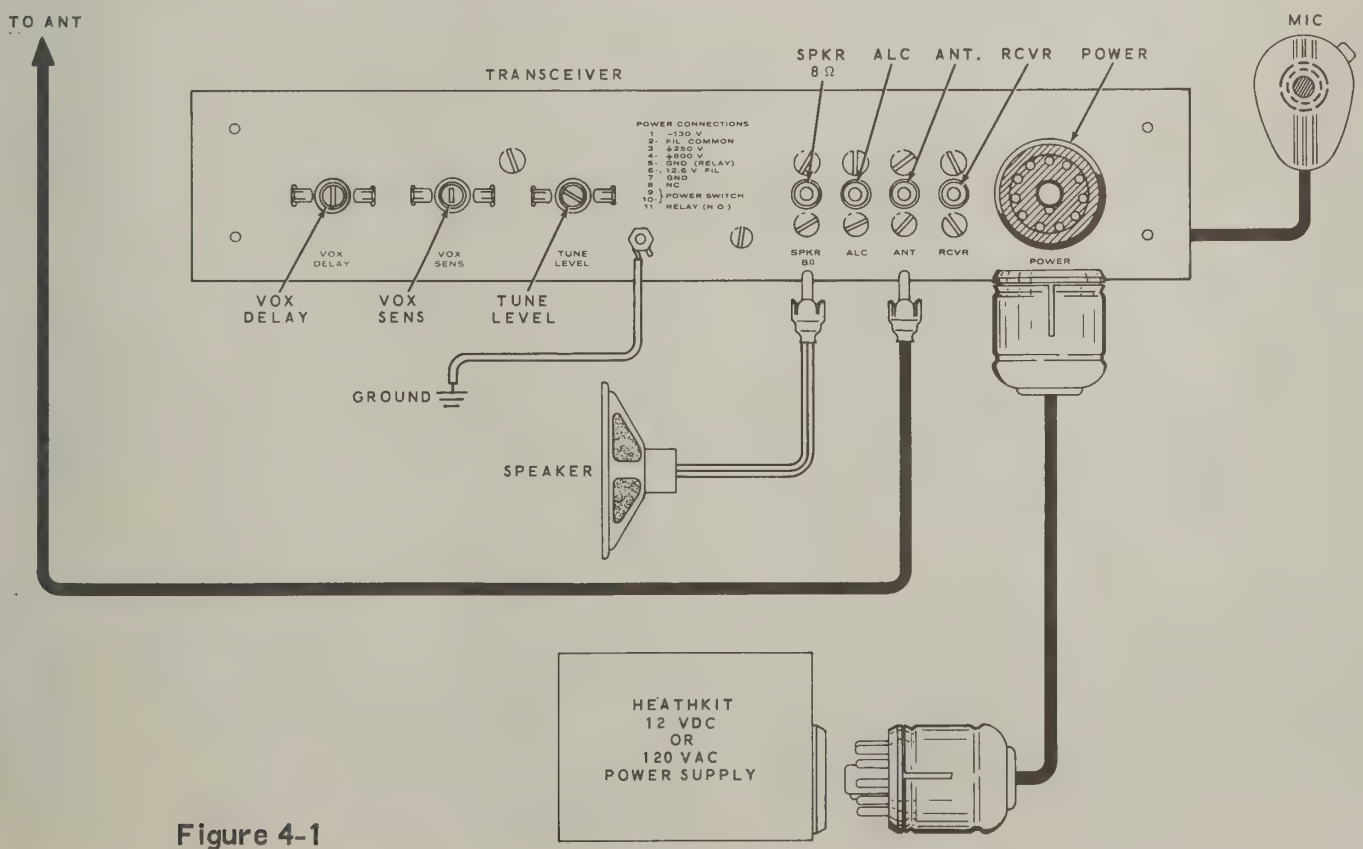


Figure 4-1

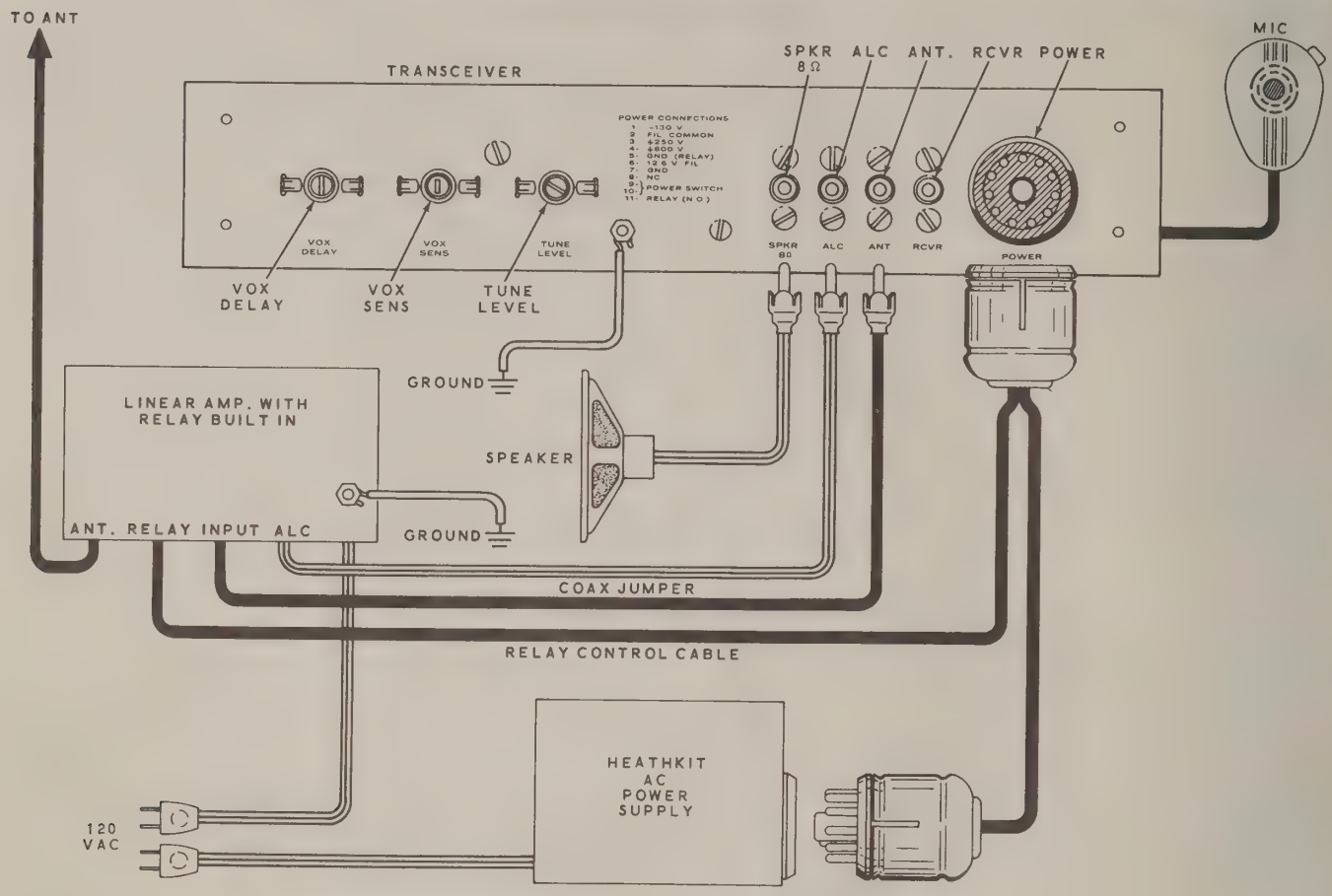


Figure 4-2

Figure 4-2 shows a fixed station installation using a linear amplifier with a built-in antenna relay switched by the Transceiver.

CAUTION: Remember that one side of the External Relay connection in the Transceiver is connected to the chassis. Therefore, it should not be connected to 120 volt AC lines for relay switching. The AC voltage could cause the Transceiver chassis to be "hot," creating a shock hazard. The switching circuit of an AC external relay must be isolated from the Transceiver by using an isolation transformer.

If low voltage DC is used on the relay switching line, be very careful to get the polarity of the voltage connected properly. The grounded DC lead must be connected to the ouside of the plug (chassis). Maximum contact ratings of the relay are: 1 ampere at 28 VDC or 120 VAC, non inductive.

MOBILE

Transceiver

The preferred location for the Transceiver for mobile operation is under the dash, although you may desire to mount the unit on the floor. See Figure 3-1 (on Page 43). The gimbal bracket should be mounted in the desired location in the automobile, using the #10 x 1/2" sheet metal screws. The starting holes for these screws should be made with a 9/64" drill, being careful not to drill into existing wiring or instruments. Keep all Transceiver cables clear of the automobile pedals and control cables.

Any cables that have to go through the fire wall will usually fit through existing grommets. If it is necessary to make holes through a sheet metal partition, a long tapered punch usually works better than a drill. A drilled holes leaves sharp edges which can cut the wires. When a punch is

driven through the metal, the sharp edge is rolled back and a smooth hole will result. Be sure to leave enough extra cable so the Transceiver can be removed from the gimbal bracket and operated, to permit adjusting the rear apron controls.

Be sure the voltage regulator of the automobile is set to not exceed 14.5 volts.

Antenna

Mount the antenna according to the manufacturer's instructions. Be sure to make a good ground connection between the shield of the coaxial cable and the car body at the antenna base.

Low-frequency antennas with loading coils must be carefully tuned, as a small change in antenna length changes the SWR considerably. The frequency range of a whip antenna on 75 meters is usually only about 25 kHz; beyond this range, loading becomes difficult or impossible without readjusting the antenna. The resonant frequency of the antenna can usually be located by noting the point of maximum noise when tuning the receiver across the band. As the antenna is adjusted, this point will move.

IMPORTANT NOTE: To make a loaded whip antenna present a 50 Ω load to match the coaxial cable on 75 meters, a capacitor usually must be connected between the base of the antenna and ground. This can be done inside the automobile body as shown in Figure 4-3, or between the antenna and one of the mounting screws, using two solder lugs, as shown in Figure 4-4. A 1000 pf mica capacitor, which is supplied with this kit for this purpose, can be used with most antennas; but a capacitor of a different value, between 300 pf and 1500 pf, may be required for proper operation of the antenna. The antenna will require retuning when the capacitor is installed.

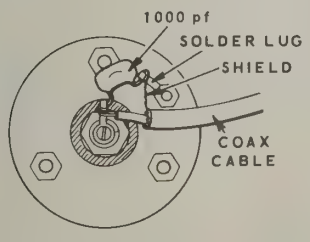


Figure 4-3

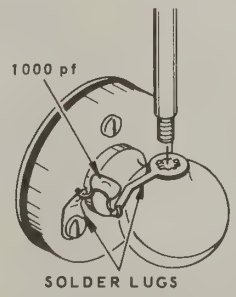


Figure 4-4

A whip antenna that is properly tuned on 75 meters will have a high peak of receiver activity for about 25 kHz around the antenna's resonant frequency. Turn on the receiver and tune through the band to discover where this high peak of receiver activity is at for the present setting of your antenna. Then adjust the length of the whip in 1/4 inch increments and retune the receiver until the peak of receiver activity is centered around the frequency at which you normally operate. The antenna can then be tuned as described in the following steps.

( ) 1. Connect an SWR meter in series with the lead to your antenna.

( ) 2. Set the SWR meter to the "forward" position.

( ) 3. Turn the Meter switch on your Transceiver to BIAS SET. If the meter needle does not point to the small triangle near "3" on the meter, perform the Bias Setting steps on Page 41.

( ) 4. Turn the FUNCTION switch to TUNE, and place the Meter switch in the OPERATE-TUNE position.

( ) 5. Connect a microphone to the MIC connector.

( ) 6. Whistle or hum into the microphone while adjusting the MIC GAIN control for a full-scale meter indication on the SWR bridge.

( ) 7. Whistle or hum at the same level and switch the SWR meter to the "reverse" position. Note the SWR reading.

( ) 8. Switch the SWR meter to the "forward" position. Then set the transmitter to higher and lower frequencies, and repeat steps 6 and 7 at each frequency, until you find the minimum SWR.

( ) 9. Set the transmitter to the desired operating frequency. Then adjust the length of the antenna as follows:

A. If the point of the lowest SWR is lower than the desired operating frequency, shorten the antenna as described below.

B. If the point of lowest SWR is higher than the desired operating frequency, lengthen the antenna as described below.

C. Change the antenna length in 1/4" increments and repeat steps 2, 6, and 7 at each new length until the minimum SWR is obtained. The SWR should be about 1.2 or less at the desired frequency. NOTE: It may be necessary to add a capacitor at the base of the antenna, as described previously, if you cannot get the SWR down to about 1.2.

NOTE: With a properly matched antenna, the FINAL TUNE knob will peak in the center third of its rotation. Since this peak is very broad, due to the fixed input capacitors of the pi network and the limited range of the FINAL TUNE capacitor, there will be only a small rise in the meter indication as the peak is tuned. Meter peaks may also occur slightly beyond the range of the FINAL TUNE capacitor, due to off-resonance operation or the varying of the antenna load impedance at different operating frequencies. However, since the output pi network has a very low Q, the output efficiency will not be much less under these conditions.

Connect the cables and mount the Transceiver in the gimbal bracket. Then position the Transceiver as desired and tighten the thumbnuts.

Accessories

The Heath Mobile Speaker can be installed in an automobile, or a car radio speaker (3.2 to 16 Ω) may be used with reduced efficiency.

Noise Suppression

To obtain good noise suppression, you must suppress electrical interference at its source, so it does not reach the input of the receiver. Once it has been radiated, noise cannot be suppressed by bypassing, etc.

It is difficult to determine the source of various types of noise, particularly when several items are contributing to the noise. Follow the procedure outlined below to isolate and identify the various items that may be producing the major noise interference.

In most cases, one source of interference will mask others. Consequently, it will be necessary to suppress the strongest item first, and then continue with the other steps. Figure 4-5 shows a typical ignition system and the suggested placement of noise suppression components.

1. Position the vehicle in an area that is free from other man-made electrical interference, such as power lines, manufacturing processes, and other automobiles.

2. With the Transceiver turned on, drive the automobile at medium speed. Then let up on the gas, and turn the ignition switch off and to the accessory position. Allow the vehicle to coast in gear. If the noise stops, the major source of interference is from the ignition system.

3. If the noise interference continues from step 2, but at a reduced level, both the ignition and generator systems are at fault.

4. If the noise has a "whine" characteristic, changes in pitch with varying engine speed, and is still present with the ignition off, then the generator is the major source of interference.

5. A distinct but irregular clicking noise, or "hash," that disappears with the engine idling, indicates the voltage regulator is at fault.

6. A steady popping noise that continues with ignition off indicates wheel or tire static interference. This is more pronounced on smooth roads.

7. The same type of interference as in step 6, but more irregular when on bumpy roads, particularly at slow speeds, indicates body static.

Refer to the Troubleshooting Chart on Page 49 and Figure 4-5 (fold-out from Page 51) to help determine how to suppress most noise interference. Naturally, not all vehicles will require suppression to the extent shown in Figure 4-5, but some stubborn cases may require all the suppression components shown, plus shielding of the ignition system.

Bonding of various parts of the automobile may also be necessary, starting from the hood and continuing to the trunk, even including bonding of the transmission line every few feet from the antenna.

Noise Suppression Troubleshooting Chart

TYPE OF NOISE	POSSIBLE CAUSE	RECOMMENDED REMEDY
Loud popping increasing to buzz with increased engine speed.	Ignition system.	1. Replace plugs with resistor type. 2. Loose crimped connections should be cleaned and soldered. 3. Place resistors in distributor system.
Whine; varies with engine speed.	Generator.	1. 0.1 μfd coaxial-type capacitor in series with the armature ("A" lead). 2. Clean commutator. 3. Replace brushes. 4. Ground generator shaft. 5. Parallel trap (#10 wire-coil and suitable capacitor) in series with armature lead, tuned to operating frequency.
Distinct but irregular clicking noise.	Voltage regulator.	1. 0.1 μfd coaxial-type capacitor in series with the battery (B) and armature (A) leads. 2. A series combination of a .002 μfd mica capacitor and a 4 Ω carbon resistor to ground from the field (F) terminal. All components should be mounted as shown in the diagram, close to the voltage regulator.
Same as above.	Energy transfer to primary system.	1. Install bypass capacitors as follows: 0.1 μfd coaxial in the lead from the ignition switch to the coil; 0.5 μfd at the battery lead to the ammeter; 0.5 μfd at the gas gauge; 0.5 μfd at the oil signal switch; 0.5 μfd at the headlight and taillight leads; 0.5 μfd at the accessory wiring from the engine compartment.
Loud popping noise that changes from one type road to another. Most pronounced on concrete.	Wheel static.	1. Install front wheel static collectors (available from most automotive distributors). These should be checked every 5000 miles for excessive wear.
Same as above.	Tire static.	1. Injection of anti-static powder into tire through valve stem.
Irregular popping noise when on bumpy roads, particularly at slow speeds.	Body static.	1. Tighten all loose screws. 2. Use heavy flexible braid and bond the engine to the frame and fire wall. Bond the control rods, speedometer cable, exhaust pipes, etc., to the frame.

If an extensive amount of suppression is required, the engine should be retimed and tuned up at a reputable garage.

OPERATION

NOTE: IT IS NECESSARY TO HAVE AN AMATEUR RADIO OPERATOR AND STATION LICENSE (GENERAL CLASS PRIVILEGES) TO PLACE THIS TRANSCEIVER ON THE AIR. Information regarding licensing and amateur frequency allocations may be obtained from publications of the Federal Communications Commission or the American Radio Relay League.

FUNCTION OF OPERATING CONTROLS

Figure 5-1 contains a brief description of the function of each control. Read the control descriptions carefully; then proceed with the following information.

VFO

Tune the VFO for the most natural-sounding voice when receiving.

Since they are already locked together in frequency, it is not necessary to zero beat the receiver frequency with the transmitter. Therefore, be careful not to disturb the VFO dial during a contact because your transmitted signal frequency will change.

SIDEBAND SELECTION

The lower sideband (LSB) is generally used on the 75-meter band. Shifting from the lower to the upper sideband (USB) causes a shift in the operating frequency of 3.4 kHz. This makes it necessary to retune the VFO to get back on the same operating frequency. The dial will read 3.4 kHz high in the USB position.

RECEIVING

The Transceiver is quite simple to operate, since there is little tuning to do after it is aligned. Turn the Transceiver on by placing the FUNCTION switch in the PTT position. After a short warmup period, stations should be heard by tuning the VFO dial. The volume is adjusted by the RF ATTN and AF VOL controls.

With the Meter switch in the OPERATE TUNE position, and the RF ATTN control at the maximum clockwise position, the meter will indicate received signal strength in "S" units, and db over S9. Normally, the RF ATTN control is operated at this maximum clockwise position. If signals are extremely strong, the RF ATTN control can be reduced to give the desired volume level, but the S METER reading will be reduced, since this control can attenuate the input signal by as much as 30 db.

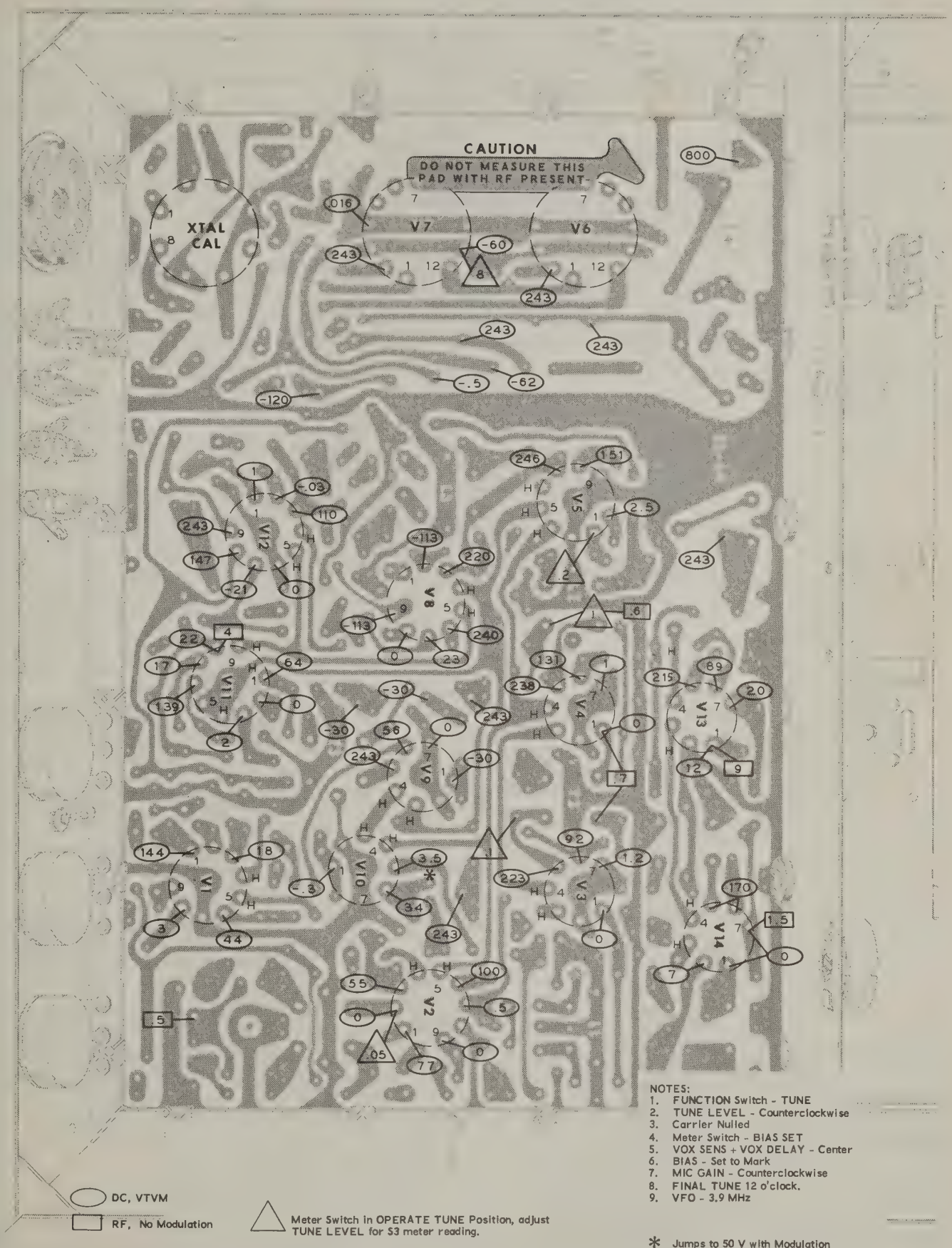
TRANSMITTING

After an operating frequency has been selected by tuning the VFO dial, turn on the transmitter by placing the FUNCTION switch in the TUNE position. Then change the Meter switch to OPERATE TUNE, and adjust the FINAL TUNE control for a maximum indication on the meter. This indicates proper tuning and maximum output power. Now put the transmitter "on the air" by placing the FUNCTION switch in the PTT or VOX position.

The meter will indicate ALC voltage while you are transmitting, when the Meter switch is set to OPERATE TUNE. As the operator talks, the meter should deflect a couple of S units, indicating maximum output peaks. The meter may rest above or below the zero mark while transmitting without harm. (The Heath Monitorscope can also be used with the Transceiver in fixed-station operation to provide a visual display of transmitter output.)

If the Meter switch is placed in the BIAS SET position while you transmit, the meter will indicate plate current variations of the final RF amplifiers. Normal talking should produce peaks at about S6 on the meter, with loud steady tones resulting in full-scale peaks. If the peaks of average talking levels are above S9, the MIC GAIN is set too high, and should be reduced to where the S6 level peaks are produced.

To keep the transmitter in peak operating condition, it should be adjusted periodically as directed in the Alignment and Adjustment section of the Manual. The BIAS ADJ control setting should also be checked and adjusted whenever power supplies are changed. After alignment has been completed and the carrier properly nulled, the bias level can be checked and adjusted anytime by observing the meter in the BIAS SET position when the PTT button is pressed, with no modulation.



NOTES:
1. FUNCTION Switch - TUNE
2. TUNE LEVEL - Counterclockwise
3. Carrier Nulled
4. Meter Switch - BIAS SET
5. VOX SENS + VOX DELAY - Center
6. BIAS - Set to Mark
7. MIC GAIN - Counterclockwise
8. FINAL TUNE 12 o'clock.
9. VFO - 3.9 MHz

DC, VTVM

RF, No Modulation

△ Meter Switch in OPERATE TUNE Position, adjust TUNE LEVEL for S3 meter reading.

* Jumps to 50 V with Modulation

TRANSMITTER VOLTAGE CHART
FIGURE 6-3

VOX

To use the voice controlled relay, place the FUNCTION switch in the VOX position. Adjust the VOX SENS control for the microphone sensitivity desired to turn on the transmitter. The VOX DELAY control should be adjusted for the hold-in time desired after the operator stops talking.

ANTENNA

The antenna must have a low SWR (standing wave ratio), since the output of the Transceiver has fixed loading and a limited tuning range. The antenna tuning should be checked with a reflected power meter or SWR bridge to make sure it has an SWR of 1.5 to 1, or less. Operation with a high SWR will result in overloading the output tubes. When using an SWR bridge, a carrier may be obtained for tuning the antenna by switching the FUNCTION switch to the TUNE position. Do not overload the SWR bridge when transmitting SSB, since the peak output power is much higher than the output power in the TUNE position.

The antenna must be matched to, and fed with, 50 Ω coaxial cable for best results; the transmitter is not designed to load into random lengths of wire or open-wire transmission lines.

Special care must be taken with mobile installations, since short-loaded and center-loaded antennas are very critical to tune. An operating frequency change of 10 or 20 kHz will often change the antenna tuning considerably. Better antennas, with loading coils, have higher "Q" and sharper tuning. Follow the antenna manufacturer's instructions carefully to obtain proper adjustment.

CRYSTAL CALIBRATION

The Heathkit plug-in Crystal Calibrator will provide convenient, accurate signals at 100 kHz intervals for receiver dial checking. The Crystal Calibrator can be plugged into the calibrator socket of the Transceiver. It is turned on by placing the FUNCTION switch in the CAL position. Do not transmit when in the CAL position because of possible interference.

IN CASE OF DIFFICULTY

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the builder.

2. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the Proper Soldering Techniques section of the Kit Builders Guide.

3. Check to be sure that all tubes and cable connections are in their proper locations. Make sure that all tubes light up properly.

4. Check the tubes with a tube tester or by substitution of tubes of the same types that are known to be good.

5. Check the values of the parts. Be sure that the proper part has been wired into the circuit, as shown in the Pictorial diagrams and as called out in the wiring instructions.

6. Check for bits of solder, wire ends, or other foreign matter, which may be lodged in the wiring.

7. If, after careful checks, the trouble is still not located and an ohmmeter and voltmeter are available, check the resistance and voltage readings against those shown in Figures 6-1 (fold-out from Page 51), 6-2, 6-3 (fold-out from Page 52), and 6-4 (fold-out from Page 55). NOTE: All voltage readings were taken with an 11 megohm input digital voltmeter. Voltages may vary as much as ±10%.

8. A review of the Circuit Descriptions will help you to know where to look for trouble.

9. Check the power supply and antenna.

NOTE: To aid in servicing or troubleshooting the Transceiver, refer to the Circuit Board X-Ray Views and Chassis Photos shown in Figures 7-1 through 7-3 on Pages 64 through 66.

Breaks in the foil of the circuit board can be detected by placing a bright light under the foil side of the board and looking through the board from the lettered side. A break will appear as a hair-line crack in the foil.

In an extreme case where you are unable to resolve a difficulty, refer to the Service and Warranty section of the "Kit Builders Guide", and to the "Factory Repair Service" information on this page.

FACTORY REPAIR SERVICE

You can return your completed kit to the Heath Company Service Department to have it repaired for a minimum service fee. (Kits that have been modified will not be accepted for repair.) If you wish, you can deliver your kit to a nearby Heath Authorized Service Center. These centers are listed in your Heathkit catalog.

To be eligible for replacement parts under the terms of the warranty, equipment returned for factory repair service, or delivered to a Heath Authorized Service Center, must be accompanied by the invoice or the sales slip, or a copy of either. If you send the original invoice or sales slip, it will be returned to you.

If it is not convenient to deliver your kit to a Heath Authorized Service Center, please ship it to the factory at Benton Harbor, Michigan and follow the following shipping instructions:

Prepare a letter in duplicate, containing the following information:

- Your name and return address.
- Date of purchase.
- A brief description of the difficulty.
- The invoice or sales slip, or a copy of either.
- Your authorization to ship the repaired unit back to you C.O.D. for the service and shipping charges, plus the cost of parts not covered by the warranty.

Attach the envelope containing one copy of this letter directly to the unit before packaging, so that we do not overlook this important information. Send the second copy of the letter by separate mail to Heath Company, Attention: Service Department, Benton Harbor, Michigan.

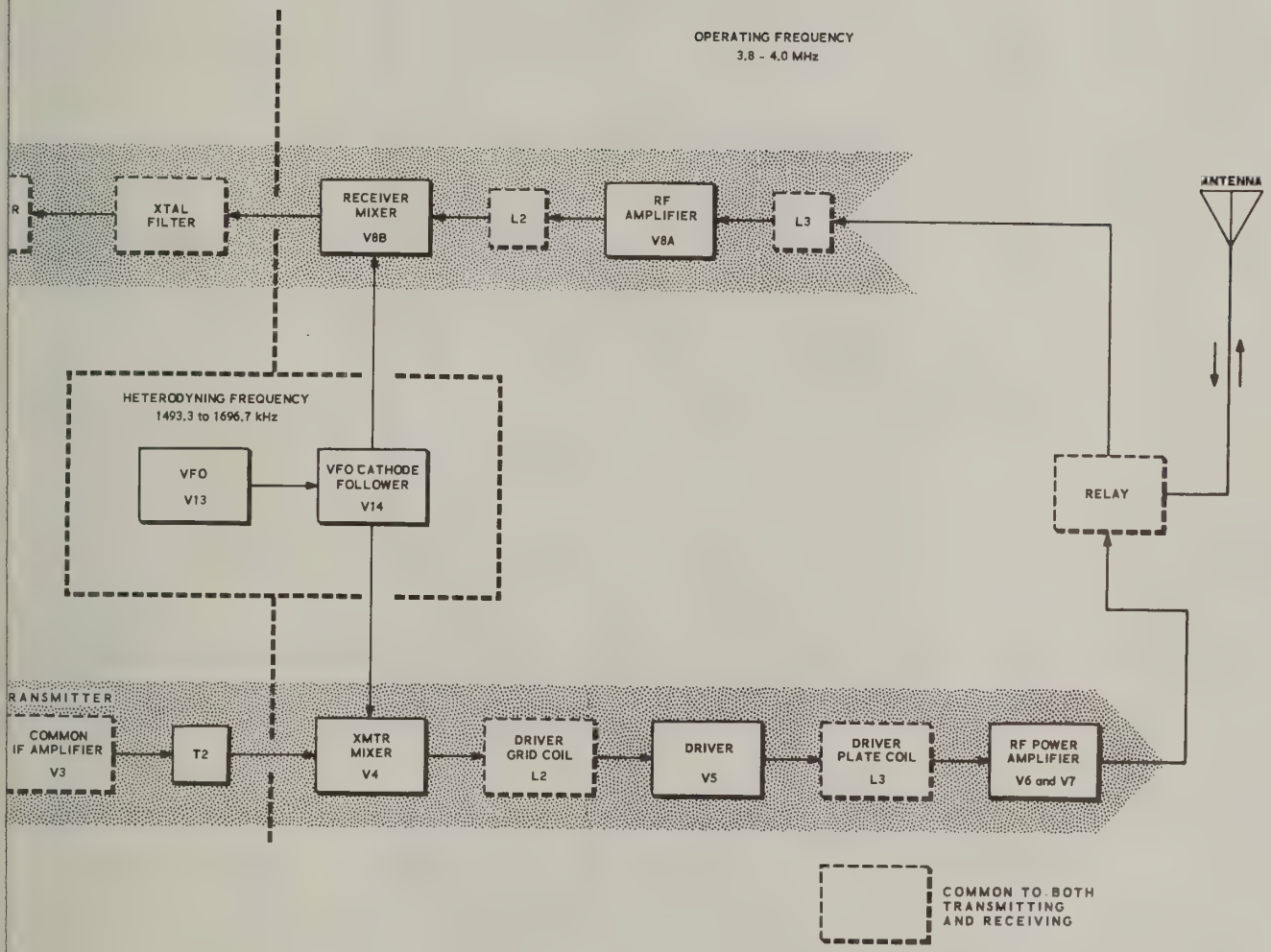
Check the equipment to see that all parts and screws are in place. (Do not include wooden cabinets when shipping receivers, tuners, amplifiers, or TV sets, as these are easily damaged in shipment.) Then, wrap the equipment in heavy paper. Place the equipment in a strong carton, and put at least THREE INCHES of resilient packing material (shredded paper, excelsior, etc.) on all sides, between the equipment and the carton. Seal the carton with gummed paper tape, and tie it with a strong cord. Ship it by prepaid express, United Parcel Service, or insured parcel post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

If you have the plug-in Crystal Calibrator, place some packing material around and above it to keep it in place in the kit. Otherwise it may work loose and break the tubes in the Transceiver during shipping.

TROUBLESHOOTING CHART

TRANSMITTER DIFFICULTIES	POSSIBLE CAUSE
CARRIER NULL control changes carrier level, but not to a low enough level.	1. FUNCTION switch in TUNE position, inserting carrier. 2. Crystal diodes CR1 through CR4 installed backwards or are faulty. 3. Transformer T1 incorrectly aligned. 4. Microphone picking up noise.
No relative power indication.	1. Resistor R61 burned out, due to transmitting without antenna. 2. Antenna shorted. 3. TUNE LEVEL set too low. 4. Faulty diode CR60.
Chopped or broken modulation, especially on peaks.	1. MIC GAIN control set too high. 2. Faulty microphone cable or connections. 3. Receiver cutoff bias line partially shorted. Check voltages and resistances.
Radical change in BIAS SET reading.	1. FUNCTION switch in TUNE position. 2. Changed power supplies without rechecking transmitter adjustment. 3. Faulty BIAS ADJ control.
Transceiver locked in transmit mode.	1. VOX DELAY control set too high. 2. Push-to-talk button stuck in depressed position. 3. Tube V10 faulty.
Plates of RF final amplifier tubes get red hot.	1. No bias on tubes. Check voltages and resistance. 2. No antenna; antenna open or shorted. 3. Antenna plugged into wrong socket. 4. Power supply voltage too high.
Very low input to grids of RF final amplifier tubes from driver V5.	1. Coils L2 and L3 improperly installed. Check color dot markings. 2. T2 not aligned properly.
Very low output, receiver works ok.	1. Antenna plugged into RCVR socket instead of ANT socket.


OPERATING FREQUENCY
3.8 - 4.0 MHz
XTAL FILTER
RECEIVER MIXER V8B
L2
RF AMPLIFIER V8A
L3
ANTENNA
HETERODYNING FREQUENCY
1493.3 to 1696.7 kHz
VFO V13
VFO CATHODE FOLLOWER V14
RELAY
RANSMITTER
COMMON IF AMPLIFIER V3
T2
XMTR MIXER V4
DRIVER GRID COIL L2
DRIVER V5
DRIVER PLATE COIL L3
RF POWER AMPLIFIER V6 and V7
COMMON TO BOTH TRANSMITTING AND RECEIVING

DIAGRAM

SPECIFICATIONS

RECEIVER SECTION

Frequency Coverage	3.8 to 4.0 megahertz.
Receiving Mode	Lower or upper sideband.
Sensitivity	1 microvolt of input signal will provide at least a 15 db signal-plus-noise to noise ratio.
Selectivity	2.7 kilohertz at 6 db down. 6 kilohertz at 50 db down.
Intermediate Frequency (IF)	2.305 megahertz.
Image Rejection	100 db.
IF Rejection	50 db.
Antenna Input Impedance	50 Ω, unbalanced.
Receiver Audio Response	400 to 3000 hertz.
Receiver Audio Power Output	1 watt.
External Speaker Impedance	8 Ω impedance.

TRANSMITTER SECTION

Frequency Coverage	3.8 to 4.0 megahertz.
Transmitting Mode	Lower or upper sideband.
Frequency Stability	Drift less than 200 hertz per hour after warmup.
RF Power Input	200 watt P.E.P.
Output Impedance	50 Ω, unbalanced.
Transmitter Audio Response	400 to 3100 hertz.
Microphone	High impedance crystal, ceramic, or dynamic (between -45 db and -60 db output).
Unwanted Sideband Suppression	45 db minimum below peak output with 1000 Hz modulation.
Carrier Suppression	45 db minimum below peak output.

CONTROLS

Front Panel.	VFO tune. FINAL TUNE. Meter switch. FUNCTION. S METER ADJ. RF ATTN. AF VOL. MIC GAIN. BIAS ADJ. Sideband switch.
Circuit Board.	CARRIER NULL.
Chassis Rear.	VOX DELAY. VOX SENS. TUNE LEVEL.

GENERAL

	12.6 V, AC or DC	800 V DC B+	250 V DC B+	-130 V DC Bias
Power Requirements -				
Transmit.	3.75 amp	250 ma peak	100 ma	5 ma
Receive.	3.75 amp	-0-	65 ma	5 ma
Crystal Calibrator (Accessory).	.3 amp	-0-	2 ma	-0-

Tube Complement. . . . . .

3 - 6EA8: Microphone amplifier and AF cathode follower - Transmitter IF amplifier and relay amplifier - RF amplifier and receiver mixer.
5 - 6AU6: VFO - VOX amplifier - IF amplifiers (2) - Transmitter mixer.
1 - 6BE6: VFO cathode follower.
1 - 12BY7: Transmitter driver.
1 - 12AT7: Product detector and carrier oscillator.
1 - 6EB8: AF amplifier and AF output.
2 - 6GE5: Transmitter RF output.

Cabinet Dimensions. . . . . .

6-1/4" high x 12-1/4" wide x 10" deep. Add 1" to height, width, and depth for gimbal bracket, knobs, and connecting plugs.

Net Weight. . . . . .

12 lbs.

Equipment Used To Prepare Specifications.	Heathkit IM-11 VTVM with 309-C RF Probe. Heathkit HO-10 Monitorscope. Heathkit IG-72 Audio Generator. Heathkit IM-12 Distortion Meter. Heathkit HN-31 Cantenna. Panoramic Radio Products, Inc. "Panalyzer," Model SB-12A. Hewlett Packard, Signal Generator, Model 606A. Tektronix Oscilloscope, Model 515A. Esterline Chart Recorder, Model AW. Boonton RF Voltmeter, Model 91-CA. Dynascan Digital Voltmeter, Model III.
Equipment Needed To Check And Calibrate. . .	VTVM and RF Probe. Dummy load. Reflected power meter. Frequency standard. Crystal-calibrated receiver, covering the 75-meter band, or an accurate broadcast receiver.

The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

CIRCUIT DESCRIPTION

The circuit of the Transceiver may be more easily understood if you refer to the Schematic Diagram (fold-out from Page 69) and Block Diagram (fold-out from Page 56) while reading the Circuit Description.

SCHEMATIC DIAGRAM

The letter-number designations on the Schematic Diagram are used to identify resistors, capacitors, chokes, etc. Each of these designations is related by its first number or two to the tube stage in which it is used. For instance, the resistors in tube stage V1 are designated R10, R11, etc. In tube stage V12 they are marked R120, R121, etc. This system of circuit component designation is used throughout the Schematic.

Numbers in diamonds on the Schematic refer to the terminals on the circuit board and the color coding of the cable assembly wires. Numbers 1 through 9 indicate solid colors; numbers 10 through 18 refer to wires with a white background and a single color stripe; and numbers 20 through 28 refer to wires with a white background and two identical color stripes. The numbers can be related to wire colors by using the same color code as used for resistors: brown = 1, red = 2, orange = 3, etc.

TRANSMITTER SECTION

Microphone Amplifier V1A

Voice signals from the microphone are coupled through capacitor C12 to the grid of microphone amplifier tube V1A. The amplified signal at the plate of V1A is coupled through C14 to the Mic Gain control, and through capacitor C102 to the VOX (voice operated transmitter) circuit. The setting of the Mic Gain control determines the amount of modulation. Since V1A supplies signals for modulation and for VOX, it operates during both receiving and transmitting. Capacitor C201 bypasses to ground

any RF signal picked up by the microphone push-to-talk switch lead.

Audio Frequency Cathode Follower

The audio signal from the Mic Gain control is applied to AF (audio frequency) cathode follower stage V1B. This stage matches the tube impedance to that of the balanced modulator. Bypass capacitor C19 keeps the modulator RF voltages from reaching V1B. During receiving, the relay cuts off V1B and a number of other transmitter stages.

Balanced Modulator

When the audio signal from V1B and the RF signal from carrier oscillator V11B are applied to the 4-diode balanced modulator, two different frequencies are produced. This ring-type balanced modulator uses diodes CR1 through CR4.

One of the two signals produced by the balanced modulator is the sum of the audio and carrier frequencies; the other signal is the difference between the audio and carrier frequencies. These signals are the upper and lower sidebands.

The carrier signal is applied across the modulator diode ring in a balanced circuit, consisting of one winding of transformer T1, capacitors C1 and C2, resistors R3 and R4, and the Carrier Null control. The Carrier Null control is used to balance out the carrier signal in the modulator, leaving only the upper and lower sideband signals at the modulator output.

The output from the balanced modulator is the result of combining the audio and carrier signals. Neither the audio or carrier signals appear in the output, but the effect of the audio signals unbalancing the nulled circuit at an audio rate produces the sum-and-difference frequencies called sidebands. With no audio, there is no output from the balanced modulator.

With the Function switch in the Tune position, a DC voltage is applied to the balanced modulator through resistors R1 and R2. This voltage can be adjusted with the Tune Level control. This DC voltage is used to unbalance the modulator to provide a steady output signal for transmitter tuning purposes.

Transmitter IF Amplifier

NOTE: Throughout the Circuit Description, it will be assumed that the Sideband switch is in the LSB position.

The sideband signals from the balanced modulator are coupled through transformer T1 and then are amplified by transmitter IF amplifier V2A. These signals are then applied to a crystal filter, consisting of crystals Y2 through Y5, and coil L1. The crystal filter eliminates the upper sideband, and permits the lower sideband to pass through to common IF amplifier V3 for additional amplification. (If the Sideband switch were in the USB position, the lower sideband would have been eliminated and only the upper sideband would pass through the crystal filter.)

Stage V2 is turned off while receiving by applying additional negative DC voltage to its grid through the secondary of transformer T1. This control voltage is impressed on the ALC (automatic level control) line, which is also used to control the gain in a number of other transmitter stages to prevent overloading. Overloading can be detected by observing the action of the meter. Normally the meter rests at or slightly below zero; however, if the operator talks too loud or if the Mic Gain control is set too high, the transmitter section would overload. This causes a change in ALC voltage which increases the bias, reducing transmitter gain and causing meter deflection to indicate ALC action.

Common IF Amplifier V3

When transmitting, V3 amplifies the lower sideband signal from the crystal filter, and then applies this signal to IF transformer T2. When receiving, the receiver IF signal is amplified by V3 and is then applied to receiver IF amplifier V9.

Transmitter Mixer V4

Transmitter mixer V4 receives two signals simultaneously; one is the SSB signal from T2, and the other is the VFO (variable frequency oscillator) signal from V13 and V14, which is coupled through the secondary of transformer T2. Tube V4 produces the frequency sum of these signals, which is at the proper operating frequency. This signal is applied to the primary of coil L2. (Tube V4 is cut off by bias voltage from the ALC line when receiving).

Coil L2, which has two windings, is broad-tuned to cover the 75-meter band. This coil is also used when receiving, and is then connected to receiver RF amplifier V8A and receiver mixer V8B.

Driver V5

Driver V5 receives the signal voltage from coil L2 through parasitic suppressor resistor R50. The ALC line is also connected to V5 to control transmitter gain, and to cut off the driver when receiving. Single-tuned coil L3 and double-tuned coil L2 form a bandpass device that covers the frequencies of the 75-meter band without the necessity of tuning the driver stage. Voltage for bridge neutralization of final amplifier tubes V6 and V7 is fed through capacitors C63 and C64 to the bottom of coil L3, and across C55. The small winding of coil L3 is used for the input signal from the antenna when receiving.

RF Final Amplifiers

RF Final Amplifiers V6 and V7 are connected in parallel. High voltage plate connections are under the chassis. The grids are connected by a long foil strip on the circuit board. This strip is bypassed at its ends by capacitor C61 and C71 to suppress VHF oscillations. Cathode resistor R71 is a meter shunt for measuring cathode current when the meter switch is in the Bias Set position.

Tubes V6 and V7 are operated as linear amplifiers, with high power sensitivity. Grid load resistor R72 is connected to the Bias Adj control through R73, to allow adjustment of the grid voltage for proper operation. The Bias Adj control is grounded through resistors R75 and R203 when transmitting. When receiving, this control is grounded through resistors R76 and R77 to increase the grid bias to cut off the final tubes.

Automatic Level Control (ALC)

No grid current is drawn by tubes V6 and V7 in normal linear operation; however, when higher than normal grid drive is applied, grid current will flow and change the bias voltage. This higher-than-normal grid drive, caused by too much audio signal, makes the bias voltage change at an audio rate. This varying bias voltage is coupled through capacitor C75 to diodes D70 and D71, which rectify the signal to develop the negative ALC voltage, which is applied to V2A, V4, and V5. Resistors R78 and R79, along with capacitor C74, filter this voltage and provide the proper time delay for ALC action. The entire ALC circuit is biased above ground by resistors R76 and R77 to cut off the transmitter section when receiving.

Transmitter Output Circuit

The plates of the RF amplifier tubes are connected to the supply voltage by choke RFC61. Their signal is coupled to the pi-section output circuit through capacitor C67. Output coil L4 is tuned by the Final Tune capacitor. Antenna loading is fixed by capacitor C77 for a 50 Ω load. With the Function switch in the Tune position, a sampling of the output voltage from resistors R61 and R62, and diode CR60, gives a meter indication to indicate proper adjustment of the Final Tune capacitor.

TRANSMIT-RECEIVE RELAY SWITCHING

Switching between transmitting and receiving is done by the relay. Section A of the relay switches the antenna, and section C switches the bias voltages.

Section B of the relay, which is connected to the external relay connection at the Power plug, can be used to control external equipment, such as a linear amplifier or antenna relay. Because one side of the external relay connection is grounded to the Transceiver chassis, the connection must not be used to switch any voltage in a circuit that operates above ground, as the chassis would become "hot," causing a possible shock hazard.

VOX AMPLIFIER V10 AND RELAY AMPLIFIER V2B

The Transceiver can be switched from receive to transmit by either the push-to-talk or the VOX method. VOX Amplifier V10 is normally operated in a saturated condition; that is, with very low plate voltage and maximum plate current. Positive half cycles of the voice signals from V1A have no effect on V10. However, the negative half cycles cause the plate current to drop, thus increasing plate voltage. This increased plate voltage fires the neon lamp, providing a positive switching action. The voltage from the neon lamp is then amplified by relay

amplifier V2B, which operates the relay. Capacitor C105 and resistor R107 form a delay network that establishes the time the relay stays closed after being tripped. The length of time is determined by the setting of the VOX Delay control.

ANTI-TRIP CIRCUIT

Because the VOX stages operate on both transmit and receive, the speaker signals during receive must be kept from tripping the relay when receiving. This is done by taking a portion of the audio signal from AF output stage V12A, rectifying it with diode D100 to produce a positive voltage, and feeding this voltage to the grid of V10 from the VOX Sens control This voltage tends to increase the plate current of V10; signals from the microphone (picked up from the speaker) tend to decrease the plate current. Therefore with both signals present at the grid of V10, the signals cancel each other, preventing the speaker from tripping the VOX circuit. Speaking into the microphone produces signals not present in the speaker circuit, permitting the VOX circuit to function normally. The VOX Sens control not only adjusts for proper anti-trip voltage, but also determines the sensitivity of the VOX circuit.

PUSH-TO-TALK CIRCUIT

With the Function switch in the PTT (push-to-talk) position, V10 is disabled by grounding its grid, and V2B is made to operate and close the relay when its grid is grounded (shorting the bias) by the push-to-talk switch in the microphone. The Function switch, in the PTT position, also makes the VOX delay circuit inoperative by removing C105 from ground. Push-to-talk operation with the Function switch in the VOX position uses the VOX delay circuit, causing the receiver to "delay" before coming on after the microphone button is released. The Function switch in the Tune position turns the transmitter on by grounding the grid of V2B.

RECEIVER SECTION

Radio Frequency Amplifier V8A And Receiver Mixer V8B

The incoming signal is connected to RF amplifier V8A through coil L3. The amplified signal from V8A is then coupled through coil L2 to receiver mixer V8B. During receiving, cutoff bias is removed from the receiver section to permit tubes V8A, V8B, V9, and V12A to operate. V8A is controlled by bias from the AVC (automatic volume control) circuit. AVC in the receiver is similar to ALC in the transmitter, in that it maintains a constant receiver output (gain) even though the incoming signal level may vary considerably. The cutoff voltage on the bias line is controlled by section C of the relay.

The RF ATTN control varies the cathode bias on RF amplifier V1, to permit receiver gain to be reduced, to prevent overloading on very strong signals. This reduction in RF gain will also be reflected in lower meter indications. Operating at a reduced RF gain, however, does not disturb the AGC circuitry, nor will it cut off the receiver completely. It simply reduces strong signals to a level that can be handled by the receiver to provide minimum cross modulation or desensitization.

Crystal Filter

The signal from mixer V8B is coupled to the crystal filter through capacitor C80, which is small in value to avoid upsetting the input impedance of the filter. The crystal filter exhibits the same characteristics in receiving as in transmitting; it shapes the IF passband to have steep sides, a flat top, and a narrow bandwidth. This permits good selectivity for SSB reception in crowded amateur bands.

Common IF Amplifier V3 And Receiver IF Amplifier V9

Signals from the crystal filter are amplified by common IF amplifier V3 and then fed to receiver IF amplifier V9. The cathode and screen of tube V9 are connected directly to those of tube V2A. The meter, which is connected in this circuit, indicates received signal strength in S units, as the AVC voltage changes the current in V9. The meter functions as an ALC indicator when transmitting, without any switching. The gain of V9 is controlled by the AVC voltage applied through resistors R91 and R92.

Product Detector V11A And Audio Frequency Amplifier V12B.

The amplified signal from V9 is coupled through IF transformer T3 to the grid of product de-

tector V11A. Also a signal from carrier oscillator V11B is fed to the cathode of V11A. A heterodyne mixing action takes place in V11A, resulting in an output signal which is the difference frequency of these two signals; an audio signal. Capacitors C111 and C112 bypass any RF signal coming from V11A, but permit the audio signal to pass through to AF amplifier V12B. The output from V12B is fed to the AF output amplifier V12A through the AF Vol control, and to the AVC circuit.

Automatic Volume Control

Audio voltage is coupled to diodes D120 and D121 through resistor R128 and capacitor C128. The diodes and capacitor C129 form a voltage doubler, producing a negative DC voltage proportional to the signal strength. Full AVC voltage is applied to the grid of receiver RF amplifier V8A to prevent overloading by strong received signals.

Capacitor C129 in the AVC circuit charges quickly to furnish a fast AVC response time, while the charging of larger capacitor C88 gives a slow AVC release time. Resistors R80, R122, R123, and R124, with capacitor C123, divide the AVC voltage applied to V9 and V12A and provide decoupling. To provide delayed AVC, resistor R123 is returned to the cathode of V12B rather than to ground. This balances the AVC voltage (which is caused by noise when no signal is being received) with a small positive voltage to improve receiver sensitivity at low signal levels.

CARRIER OSCILLATOR

Carrier oscillator V11B supplies an RF signal to the balanced modulator, and a heterodyning signal to product detector V11A. Tube V11B is a Colpitts type oscillator. Crystal Y1 or Y6 determines the operating frequency to accurately maintain the proper frequency relationship with the crystal filter bandpass frequencies. Capacitors C117 and C118 provide feedback to maintain oscillation. The output is taken from the junction of capacitors C115 and C116. The crystal for the desired sideband is selected by the Sideband switch.

Audio Frequency Output Amplifier V12A

Amplified audio signals from V12A are fed to the speaker socket through output transformer T4. To provide maximum intelligibility, the frequency response of the output stage is limited to the voice frequency range by a sharp-cutoff, high frequency, degenerative feedback loop. High frequencies across RFC120 causes its impedance to rise. The high frequencies are re-

turned out-of-phase to the grid of V12B by C126. This signal cancels out the incoming high frequency audio and noise signals at the grid of V12B. Capacitor C120 is a low frequency bypass to ground, and capacitor C127 serves as a parasitic oscillation suppressor.

VFO

Variable frequency oscillator V13 is also a Colpitts type oscillator, which operates at low frequencies for maximum stability. Coil L5 provides the necessary inductance, while capacitors C132, C133, and C134 form a divider for oscillator feedback and output connections. C205 is a negative temperature coefficient capacitor for temperature correction. The oscillator output is taken from the junction of capacitors C133 and C134, and is applied to V14. The harmonics are suppressed by capacitor C134. The signal output from V14 is connected to receiver mixer V8B through capacitor C142, and to transmitter mixer V4 through a filter circuit comprised of choke RFC140, and capacitors C140 and C141. The filter circuit separates the VFO frequencies from the IF and RF signals also present at this point, thus stopping signal leakthrough which would cause spurious oscillation in the IF stages.

ACCESSORY CRYSTAL CALIBRATOR

The accessory plug-in crystal calibrator is turned on by applying B+ to it. This occurs when the Function switch is in the CAL position. The calibrator filament circuit is grounded internally to the calibrator chassis. For this reason, the calibrator chassis must not be grounded to the Transceiver chassis. Resistor R6 is the calibrator plate current return; resistor R5 drops the calibrator filament voltage to 6 volts.

FILAMENTS

The filament wiring of the Transceiver is a series-parallel arrangement that balances the filament voltage without wasting power in dropping resistors. This filament arrangement allows the use of both 6 volt and 12 volt filament tubes in the Transceiver design. The filaments of RF power amplifiers V6 and V7 are isolated by choke RFC60 to prevent RF energy from getting to the other tube filaments.

POWER SUPPLY

Operating voltages for the Transceiver are provided by an external power supply. The power supply is turned on or off by the Function switch, which is wired through the Transceiver Power plug to the external power supply.

CHASSIS PHOTOGRAPHS

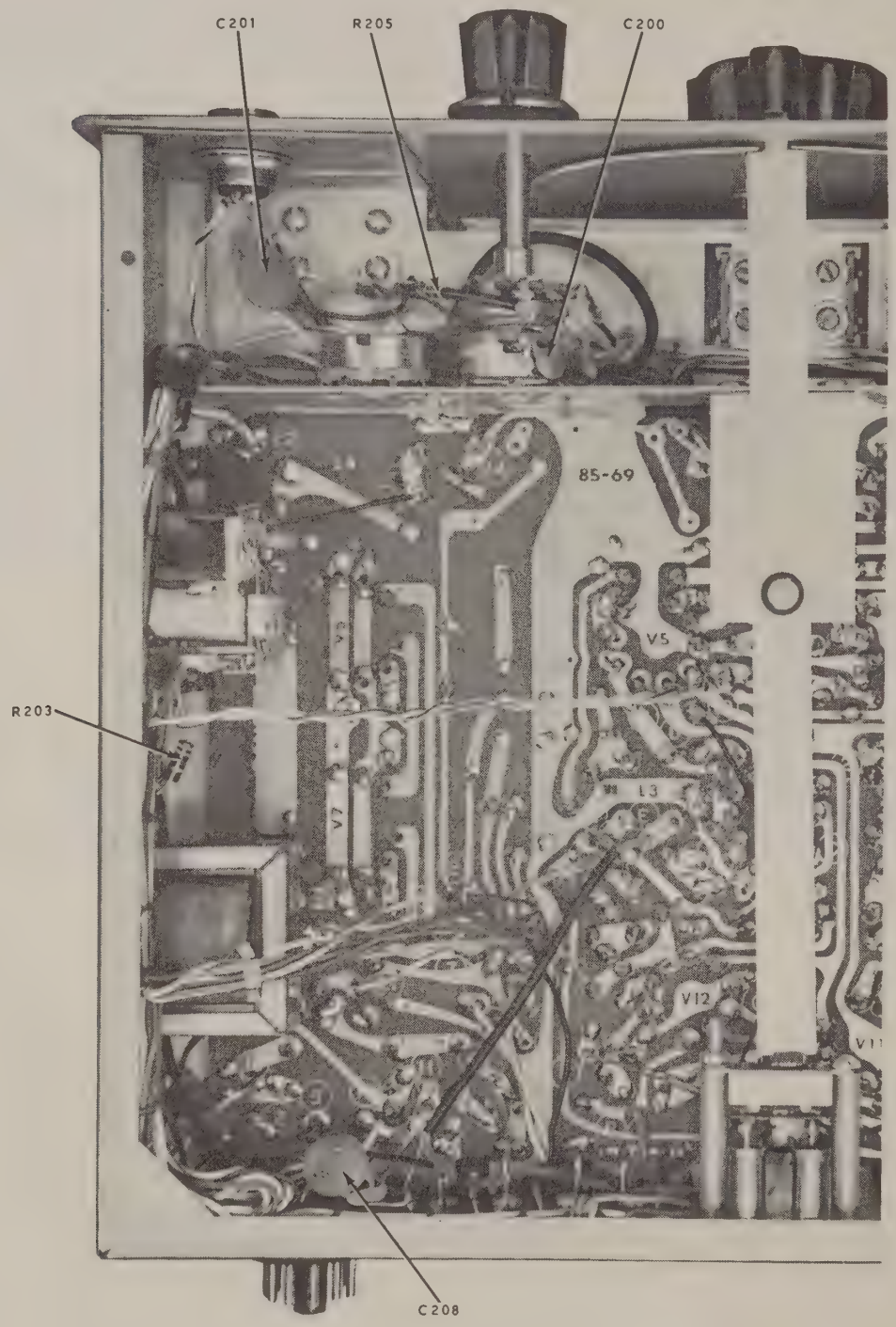
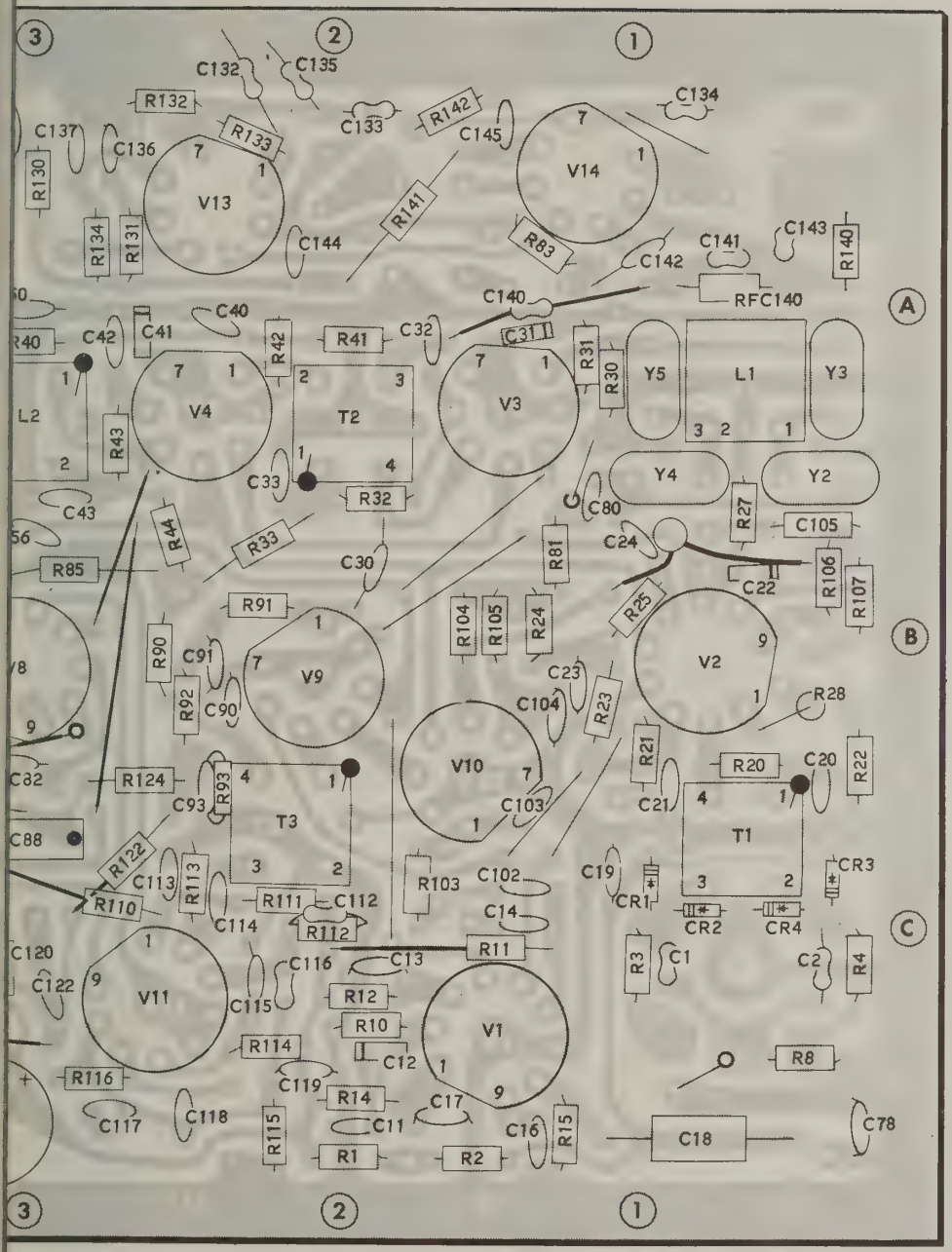


FIGURE 7-1

RD X-RAY VIEW
ROM FOIL SIDE)



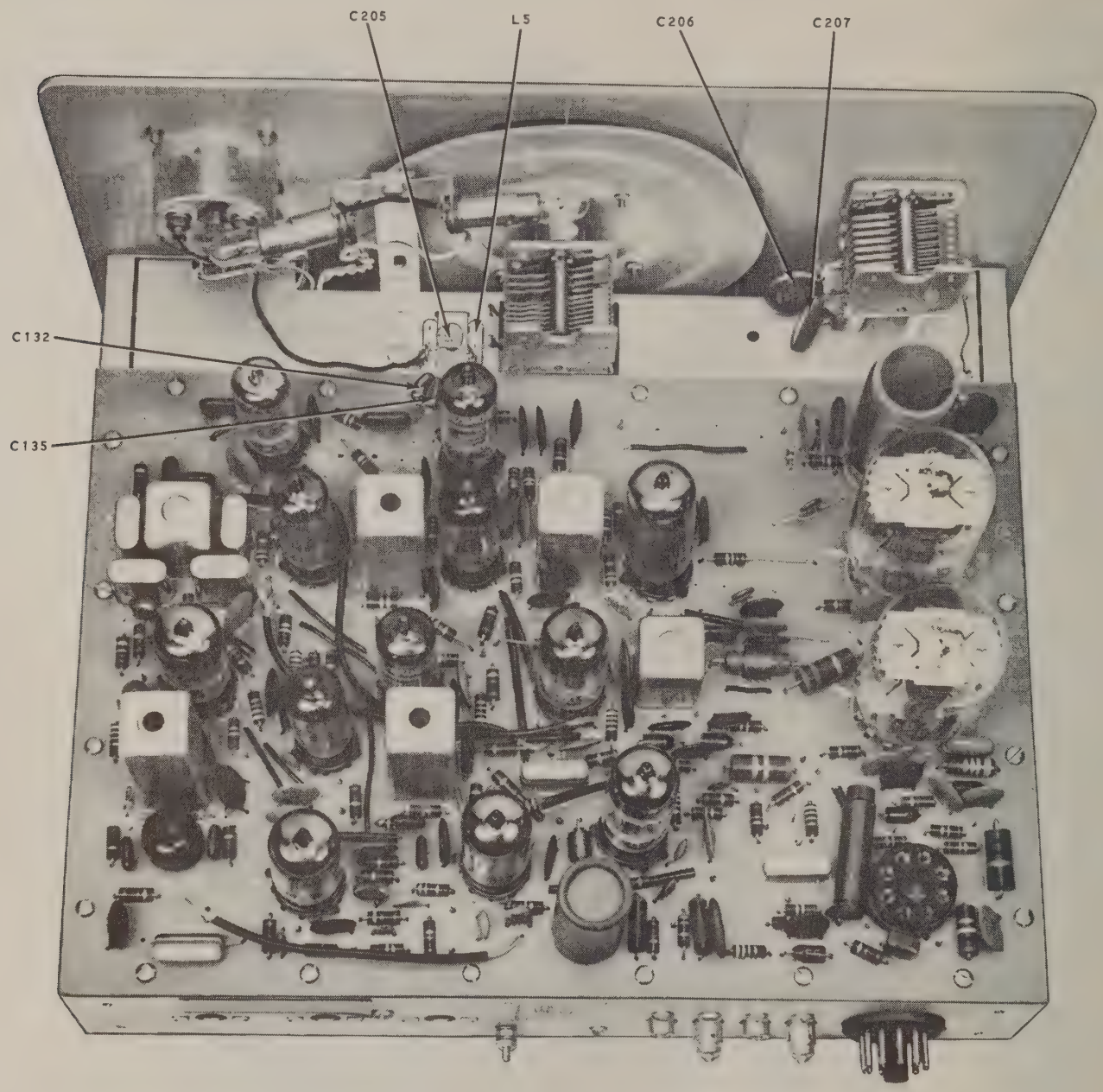


FIGURE 7-3

REPLACEMENT PARTS PRICE LIST

To order parts, use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to Replacement Parts in the Kit Builders Guide.

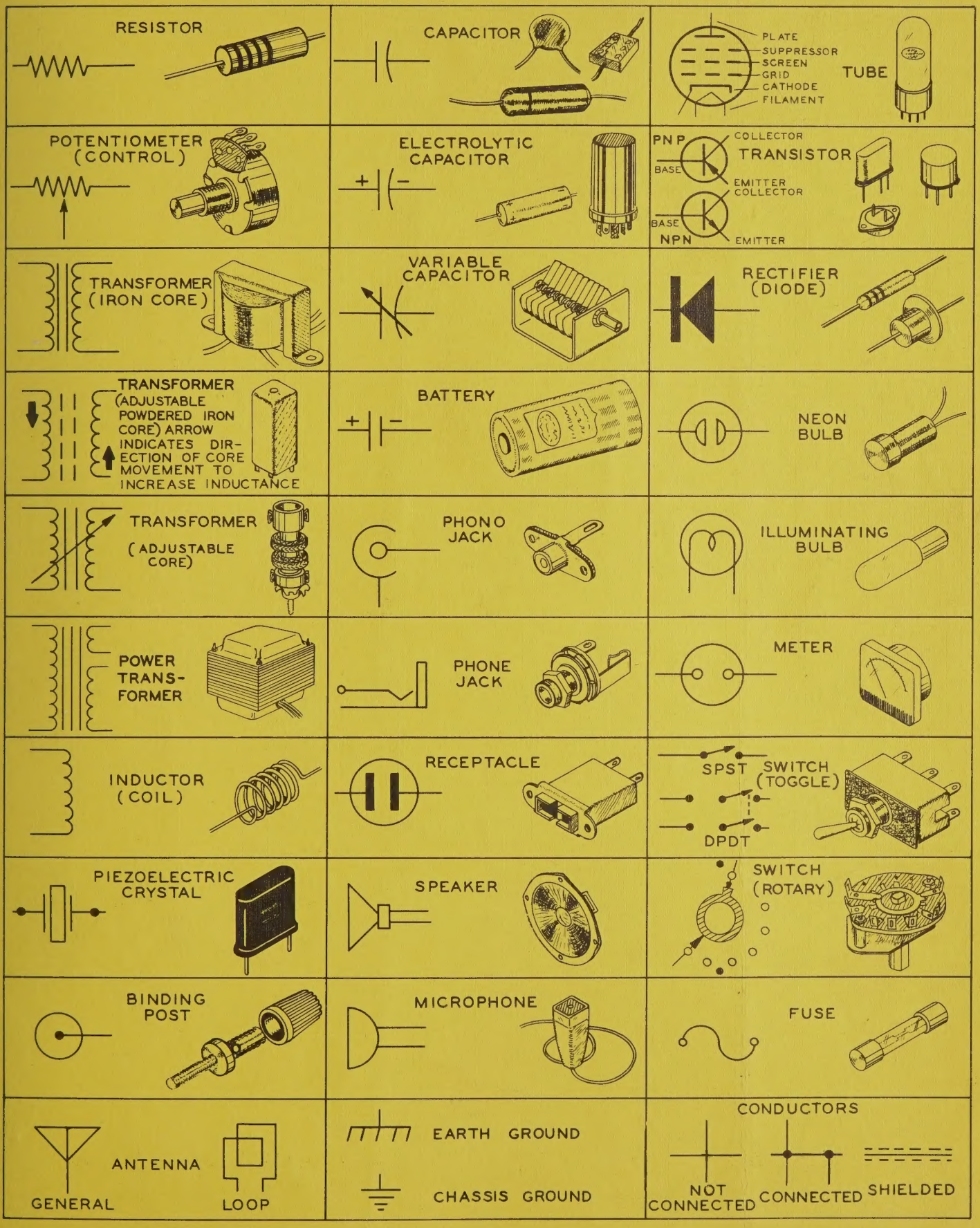
PART No.	PRICE Each	DESCRIPTION
RESISTORS		
1/2 Watt		
1-1	.10	47 Ω
1-3	.10	100 Ω
1-66	.10	150 Ω
1-45	.10	220 Ω
1-4	.10	330 Ω
1-9	.10	1000 Ω
1-14	.10	3300 Ω
1-16	.10	4700 Ω
1-19	.10	6800 Ω
1-20	.10	10 KΩ
1-22	.10	22 KΩ
1-25	.10	47 KΩ
1-26	.10	100 KΩ
1-29	.10	220 KΩ
1-35	.10	1 megohm
1-37	.10	2.2 megohm
1-70	.10	22 megohm
Other Resistors		
1-28-1	.10	100 KΩ 1 watt
3-2-2	.25	.33 Ω 2 watt
1-21-1	.35	20 Ω 2 watt
1-17-2	.20	6800 Ω 2 watt
1-22-2	.20	12 KΩ 2 watt
CAPACITORS		
Mica		
20-96	.15	36 pf
20-102	.15	100 pf
20-112	.25	310 pf
20-131	.25	360 pf
20-122	.30	1000 pf
20-127	.40	1300 pf
Disc		
21-60	.10	18 pf
21-32	.10	47 pf
21-49	.20	68 pf
21-21	.10	200 pf
21-13	.10	500 pf
21-35	.15	.005 μfd 1.6 KV
21-57	.10	.005 μfd
21-31	.10	.02 μfd
Mylar		
27-73	.15	.047 μfd
27-85	.25	.22 μfd
27-61	.45	.47 μfd
27-47	.20	.1 μfd
Other Capacitors		
25-54	.40	10 μfd tubular electrolytic
25-135	.75	20 μfd vertical electrolytic
26-104	2.45	Double-section variable
26-35	1.65	Single-section variable
COILS		
40-509	.75	Crystal filter
40-516	1.90	Driver grid
40-513	1.20	Driver plate
40-510	.80	Final plate
52-25	.65	VFO
CHOKES-TRANSFORMERS		
45-58	.55	13 μh bifilar choke
45-51	.25	15 μh choke
45-3	.30	1 mh choke
45-4	.40	1.1 mh choke
45-47	.30	2 mh choke
51-55	1.75	Audio output transformer
52-63	1.10	2.305 MHz transformer
CONTROLS-SWITCHES		
10-130	.75	200 Ω bushing-mount control
10-17	.55	1 megohm bushing-mount control
10-57	.35	10 KΩ tab-mount control
10-58	.35	100 KΩ tab-mount control
10-127	.35	1 megohm tab-mount control
12-73	1.70	1 megohm/25 KΩ dual tab-mount control
60-13	.20	DPDT slide switch
63-427	3.40	5-position rotary with/snap switch
CRYSTALS		
404-196	3.75	2303.3 kHz
404-197	3.75	2306.7 kHz
404-203	17.75	Package consisting of the following:
404-191		2305.100 kHz] Matched set
404-192		2303.500 kHz]

PART No.	PRICE Each	DESCRIPTION
DIODES-TUBES-LAMPS		
56-26-1	.35	Germanium diode
57-27	.60	Silicon diode
411-11	1.00	6AU6 tube
411-91	1.20	6BE6 tube
411-124	1.50	6EA8 tube
411-161	2.20	6EB8 tube
411-185	1.95	6GE5 tube
411-24	1.45	12AT7 tube
411-69	1.55	12BY7 tube
412-1	.15	#47 pilot lamp
412-11	.20	NE2 neon lamp
CONNECTORS-SOCKETS-PLUGS		
432-38	1.10	Male connector
432-39	1.10	Female connector
434-42	.10	Phono socket
434-44	.15	Pilot lamp socket
434-112	.10	7-pin tube socket
434-105	.15	8-pin tube socket
434-79	.15	9-pin tube socket
434-140	.20	12-pin tube socket
434-118	.40	11-pin tube socket
438-4	.10	Phono plug
438-29	.40	11-pin plug
440-1	.20	11-pin plug cap
CABLE-WIRE-SLEEVING		
134-140	5.90	Cable assembly
343-7	.05/ft	Coaxial cable
344-50	.05/ft	Black hookup wire
344-52	.05/ft	Red hookup wire
346-1	.05/ft	Small sleeving
346-2	.05/ft	Large sleeving (clear)
KNOBS		
462-7	.10	Push-on
462-106	.10	11/16" diameter
462-191	.70	1-1/8" diameter
462-210	1.05	2" diameter
462-218	.25	Lever

PART No.	PRICE Each	DESCRIPTION
GENERAL		
69-34	5.00	Relay
73-1	.10	Rubber grommet
75-52	.10	Slide switch insulator
85-69-9	5.00	Circuit board
259-20	.05	Terminal
260-7	.05	IF transformer mounting clip
261-4	.05	Small rubber foot
261-9	.05	Medium rubber foot
261-21	.20	Large rubber foot
407-99	9.85	Meter
431-14	.10	2-lug terminal strip
435-1	.10	11-pin plug mounting ring
455-11	.10	Split bushing
455-52	.10	Lever knob bushing
464-29-1	1.15	Plastic dial
490-1	.10	Alignment tool
490-5	.10	Nut starter
331-6	.15	Solder
	2.00	Manual (See front cover for part number.)
METAL PARTS		
204-576	1.45	Gimbal bracket
90-265	6.60	Cabinet
206-312	1.05	Final shield
204-182	.10	Final shield mounting bracket
204-453	.10	Pilot lamp mounting bracket
100-596-2	2.60	Chassis
100-43	.25	Dial mounting plate
204-732	.10	Switch lever mounting bracket
266-90	.10	Switch lever
100-597	1.35	Front panel
HARDWARE		
#3 Hardware		
250-49	.05	3-48 x 1/4" screw
252-1	.05	3-48 nut
254-7	.05	#3 lockwasher

TYPICAL COMPONENT TYPES

This chart is a guide to commonly used types of electronic components. The symbols and related illustrations should prove helpful in identifying most parts and reading the schematic diagrams.



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